Project Number: VG15003

Application of intelligent sensing systems, robotics & precision agriculture automation in vegetable production systems
July 2015

TOPIE AND VEGETABLES: (What is the topic and what vegetables should be addressed?)
Application of intelligent sensing systems, robotics and precision agriculture automation (Hort Technologies) in vegetable production systems

CLIENT: (Who is commissioning the project?)
Horticulture Innovation Australia Limited (HIA) is commissioning this project. HIA is a not-for-profit, grower-owned research and development corporation for Australia’s $9 billion horticulture industry. HIA invests around $100 million in Research and Development (R&D) and Marketing programs annually to provide benefit to industry and the wider community. HIA delivers national research and development programs for the Australian vegetable industry.

For further information visit www.horticulture.com.au

PROJECT PURPOSE: (What is the purpose of the project - in a nutshell?)
This overarching project aims to:
- Develop and evaluate new methodologies for estimating and mapping on-farm productivity (yield, product quality attributes and crop forecasting) across target crops in vegetable production systems.
- Utilize novel sensor technologies to develop algorithms and where applicable, platforms for precision application of inputs in vegetable production systems.
- Determine opportunities for integration of intelligent sensing systems, robotics and precision agriculture automation across vegetable production systems in light of Australia’s policy/regulatory environment and current farming practices/systems.

STRATEGIC CONTEXT: (How does this project fit into current strategic plans?)
- Relevant SIP Objective 3: Farm Productivity, Resource Use and Management (FPRUM)
- Relevant SIP Strategies:
  - ADOPTION OF TECHNOLOGIES / COLLABORATION
  - MECHANISATION, AUTOMATION AND ROBOTICS

Refer to the Vegetable Industry Strategic Investment Plan for more details. A copy can be obtained from the HIA PM or via AUSVEG.com.au.

HISTORY AND CURRENT SITUATION: (Where we are now and how did we get here?)
The Australian vegetable industry has identified the need for intelligent sensing systems, robotics and precision agriculture automation (Hort Technologies) to reduce production costs and increase on farm productivity on farm. Hort Technologies are also being looked upon to better manage risk, internal and external to the business. The need to drive competitiveness with international markets has further propelled focus in this area as well as the need for growers to increase performance in order to adequately compete with other emerging economies with significantly larger and cheaper labour pools. Indeed, labour costs represent an average 30% of total farm costs across the vegetable sector with many tasks relying on manual labour. Emphasis on minimising risks in managing work health and safety is another factor driving the horticultural sector to look beyond conventional farming systems.

Several project concepts relating to Hort Technologies were raised by vegetable industry value chain partners during the Farm Productivity, Resource Use & Management Meeting held on 32/4/15. These have been distilled further using Horticultural Technology for the Australian Vegetable Industry Investment Framework developed by HIA and the vegetable industry.

**CHANGE REQUIRED IN FUTURE (OUTCOME):**
(What changes would the industry like to achieve as a result of the outcome of this project?)

- Commercial application of Hort Technologies to estimate and map yield, product quality to assist with product scheduling and forecasting in vegetable production systems.
- Commercial application of Hort Technologies to improve crop performance and input resource use in vegetable production systems.
- Commercial application of Hort Technologies to improve (or automated real-time) decision making in vegetable production systems.
- Commercial application of Hort Technologies to allow better management and achieve more uniform crops in vegetable production systems.
- Commercial application of Hort Technologies to predict optimum harvest time would be beneficial in maximizing pack out in vegetable production systems.
- Understand the policy framework at the national, state/territory and local levels and identify where changes may be made to drive greater use of Hort Technologies approved for autonomy across vegetable value chains.
- Address the underlying barriers to Horticultural Technology and regulations to ensure that what is being achieved and supported by the vegetable industry is entrenched into the legislation for future use.

**THE TARGET AUDIENCE:**
(Who are we trying to reach or influence with the results of this project?)
Australian vegetable growers and commercialisation partners.

**MEASURES OF SUCCESS:**
(How will we measure a successful outcome?)

- This project will yield a suite of Hort Technologies that are commercially available (or have a clear pathway to adoption via an exploitation plan) for implementation within vegetable production systems to reduce costs, increase productivity and ensure these systems are aligned, agile, responsive to change and globally competitive.
- This project will also raise the awareness and drive adoption of Hort Technologies among vegetable growers.

*Service provider to suggest SMART measurement metrics and propose the measurement tool(s) to be used to determine whether a successful outcome is achieved*

**INDUSTRY STAKEHOLDERS:**
(Which industry participants should be included in the development or conduct of the project?)

<table>
<thead>
<tr>
<th>Key stakeholders</th>
<th>Australian vegetable grower segment, technology partners</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIA Portfolio Manager</td>
<td>Dr Anthony Kachenko</td>
</tr>
<tr>
<td>IRB Representative</td>
<td>TBA</td>
</tr>
<tr>
<td>Grower Partner</td>
<td>Ed Fagan and others TBC</td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

*Note: contact details for some stakeholders may be supplied to the successful tenderer on request and subject to privacy laws.*
### SCOPE AND DELIVERABLES:
(What outputs (Goods, Services, Information) are we expecting to be delivered at the end of the project?)

This should:

- **Within scope.**
  - Detailed report that to provide industry and associated stakeholders with a clear "map" of barriers and opportunities for integrating Horticultural Technology in vegetable production systems
  - Exploitation plan to manage the impact of Project IP
  - Market ready Hort Technologies that can undertake precision application of farm inputs (linked to the Lady bird robot and/or independent)
  - Market ready Hort Technologies that can undertake yield, quality analysis and crop forecasting (linked to the Lady bird robot and/or independent)
  - Farm trials and farm demonstrations incorporating evaluation, testing and extension of project outputs

- **Specific deliverables (outputs)**
  - HIA Final Report
  - Communication Summaries for HIA and AUSVEG communications
    - Start of Project Summary
    - End of Project Summary
  - Availability to provide two presentations of findings to vegetable industry stakeholders (e.g. advisory committees) as required
  - Communications and extension of project findings to ensure industry uptake of research recognising and utilising existing industry communications and extension channels where possible

### RESEARCH PRINCIPLES AND TOOLS:
(What approach to the research do we require?)

- **Stage 1** Desktop review and analysis including identification of commercialisation partners
- **Stage 2** Consultation with industry
- **Stage 3** Experimentation via laboratory and field trials
- **Stage 4** Preparation adoption plan and further evaluation
- **Stage 5** Reporting and evaluation

### REFERENCES AND SOURCES:
(What sources of information are available?)

**Supporting Documentation**
The following previous research documents may assist with tender submission and subsequent project development.

- VG13081 – Prioritisation of Vegetable Crop Commodities and Activities for Mechanisation
- HG09044 – Scoping study to review Mechanisation, Automation, Robotics and Remote Sensing in Australian horticulture

*To access reports visit the [AUSVEG – R&D Database](#) or speak to the designated HIA R&D Portfolio Manager*

**Related work**
Service providers should also note and refer to the related work that will be undertaken concurrently with this project in the following areas. This work is currently being tendered or is already underway:

- VG12104 – Intelligent Farm Robot for the Vegetable Industry
- VG13113 – Evaluation of automation and robotics innovations: developing next generation vegetable production systems
- AH11009 – Autonomous Perception Systems for Horticulture Tree Crops

### REPORTING, COMMUNICATION AND EXTENSION CHANNELS:
How should the findings be communicated and extended?

Service provider should be prepared to work collaboratively with HIA and the industry representative body AUSVEG Ltd in developing content for the following communications:

- HIA website and enews
- Vegetables Australia Magazine
- Special Publications and flyers
- AUSVEG web portal
- R&D Update member emails
- Media requests

*Service provider to outline communication and extension plan that ensures awareness and uptake of research outputs*
Specific budget guidance for this project is not provided. However the following context will assist the tendering party in developing a submission.

**a.** There are eight (8) Round 7 tenders within the *Farm Productivity, Resource Use & Management Objective:*

- VG14047 - Landscape diversity and field margin management
- VG14048 - Review of current Vegetable irrigation technologies
- VG15003 - Application of intelligent sensing systems, robotics and precision agriculture automation in vegetable production systems
- VG15008 - Vegetable viruses – Viruses of National Importance to the Australian Vegetable Industry
- VG15009 - Improved soilborne disease diagnostic capacity for the Australian Vegetable Industry
- VG15010 - A multi-faceted approach to soil borne disease management
- VG15012 - Improved foliar disease management through predictive modelling
- VG15013 - Improved management options for Cucumber green mottle mosaic virus

**b.** Total approximate life of project funds available in total to be split (not necessarily evenly) across all listed projects at (a): $5,250,000.00 *(Ex GST).*

**RESPONSE AND SELECTION CRITERIA (see Appendix for further information)**

The criteria for selection will include:
- Demonstrates a clear understanding of the project requirements.
- Demonstrates an awareness of supporting documentation, previous and related (ongoing) research or work.
- Description of the proposed methodology to address the project terms of reference and timeframes.
- Project plan: outlining activities to be undertaken each month/quarter and to be reported against at each milestone.
- Clearly outlined budget that demonstrates value for money, with justification for all expenditure items over $1000.
- Outline experience, history and competence of the service provider and nominated personnel to undertake the work.

**APPENDIX**

**Standard Reporting Requirements**

Each project is responsible for delivering the following compulsory outputs in addition to any project specific outputs:
- HIA Final Report: The final report should detail the method and activities, evaluation outputs, recommendations, and financial reconciliation of the project in accordance with the HIA reporting guidelines.
- Communication Summaries to be placed in industry magazine and other communications vehicles:
  - Start of Project Communications Summary: A one page (300-word maximum) summary to be written within one month of the project’s start date and emailed to the relevant HIA Portfolio Manager, who will then directly forward it on to the Industry Representative body. The summary must outline the project’s goals and aspirations, as well as the intended timeframe and any major research tasks. It must be written in a lucid manner with realistic expectations. The information may be used in communications material at the discretion of HIA or the Industry Representative Body.
  - End of Project Communications Summary: A one page (500-word maximum) summary to be written and submitted in conjunction with the HIA Final Report. Once approved, the relevant HIA Portfolio Manager will forward it on to the Industry Representative Body. The summary must outline the findings of the project and how they were reached, as well as the scope for future research. It must also clearly highlight the achievements and obstacles the project encountered. The focus of the summary is to identify how growers can practically apply the outcomes on-farm and how it benefits the industry overall. The summary must be written in a lucid manner with accurate evidence. The
information may be used in communications material at the discretion of HIA or the Industry Representative Body.

- Presentation of findings to vegetable industry advisory panels as needed.

**Levy Payer Partnership**

As nominated in the Vegetable Industry Strategic Investment Plan (SIP) 2012-2017, a condition of being awarded the project is that the successful applicant may be required to form a working partnership with a vegetable levy payer who will liaise with the applicant throughout the project to provide industry insight. Projects required to engage with a designated Grower Partner will be advised post contracting as not all projects will be required to partner with a levy payer.

The role of the Grower Partner is to:

- Develop an understanding of the proposed outputs and outcomes expected from the project.
- Provide input and feedback to the Service Provider throughout the project to ensure that the project outcomes are relevant and implementable for the vegetable industry.

The successful applicant, as the Service Provider, will have the responsibility of making contact with the Grower Partner, arrange a brief project inception meeting (via phone or face to face) and then liaise with the Grower Partner regularly (by agreement with the Grower Partner) during the delivery of the project. Service Providers are expected to respect the Grower Partner's time and ensure that all contact is made at convenient times and places for the Grower Partner. This element of the project can be settled once the project is awarded.

**Resource Allocation**

Applicants will provide their own administrative support, including word processing and printing requirements. Applicants will be responsible for the research and collation of data and presentation to HIA in the requested format. The HIA contract allows for the provision of assistance in accessing relevant HIA documents and appropriate HIA and industry representatives as may be agreed to. Principle personnel allocated to the project cannot be changed throughout the project without the prior agreement of HIA.

**General Conditions of Contract**

A contract will be produced with the selected applicant as per HIA’s standard contracting process. HIA expects that:

- Confidentiality will be maintained at all times.
- All intellectual property (including but not limited to the copyright in all reports) developed, as the result of a project, will be assigned to HIA.
- The project is undertaken in an impartial, objective and professional manner.
- EEO principles will be applied in both the selection of personnel for the project and in the conduct of the project.
- The applicant has insurance cover for property damage and public risk, public liability and accident or injuries to employees of their company.
- Any areas of potential conflict of interest be identified at the time of the applicant's response to the brief and updated during the course of the project should potential conflicts arise.
- The applicant's contract may be terminated or the work content reduced, with a fair and reasonable monetary adjustment determined by HIA, subject to the applicant being given notice in writing.
- Any material provided by HIA for this project will be used only for this project and remains the property of HIA.
- No legal relations with regards to any proposal will arise unless a legal agreement with HIA has been executed.
- Successful applicants will be required to expand on the 5 page tender submission by uploading a full proposal via the HIA online portal (HALO) that will be assessed by HIA Portfolio Manager through the contracting phase.

**Qualifications of Consultants:**

- A statement of the name, role, qualifications and experience of person to be allocated to the project must be provided.
- Current references, which would demonstrate the experience of both the organisation and personnel nominated for this project, must also be provided.
- Contact details for the person nominated for involvement in the project.
- Clearly identify the main contact for correspondence.
- Clearly identify the company or business involved in the proposal lodgement.
Reference Formats
References listed within the report should be displayed in the following format:

HOW TO APPLY
- Tender Queries
  For any queries on the tender please contact the HIA R&D Portfolio Manager. Responses to queries may be made available to all tenderers via blind copy email circular. The HIA Portfolio Manager for this project is:

  Name: Dr Anthony Kachenko
  Title: R&D Team Leader & Portfolio Manager
  Email: Anthony.kachenko@horticulture.com.au
  Phone: 0282952343

- Tender Lodgement
  To respond to this tender please submit a brief (max of 5 pages excluding cover page) tender proposal including acknowledgment that all terms and conditions stated in this brief are accepted. NB: Pages in excess of the cited limit will not be assessed as part of the proposal and the submission deemed a non-conforming tender.

  Proposals will need to be prepared and submitted to HIA as follows:

  Tender submissions MUST be emailed to tenders@horticulture.com.au no later than 2pm, 30 July 2015.

  The Designated Tenders Administration Manager responsible for tender receipt is:

    Nina Phanekham
    Horticulture Innovation Australia
    Level 8, 1 Chifley Square
    Sydney NSW 2000
    T 02 8295 2311
    E tenders@horticulture.com.au

  NB: Although the HIA Portfolio Manager is listed as a contact for subject matter queries, please DO NOT submit your tender to the HIA Portfolio Manager. The HIA Tenders Administration Manager provides submissions to HIA Portfolio Manager only after tenders close in adherence to governance protocol.

  Late proposals, faxed proposals, or proposals that do not concur with the tender requirements will NOT be considered.