strengthenINg diGital pEdagogy skills aNd competencIes Of edUcatorS

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Abbreviations and Acronyms

Abbreviations and Acronyms:	
SFC	SISTEMI FORMATIVI CONFINDUSTRIA
ITS	HIGHER TECHNICAL EDUCATION (ISTRUZIONE TECNICA SUPERIORE)

1-1. IMPLEMENTATION OF ASSESSMENT PROCEDURE

1-1.1 Determining the boundaries of the test group

In Italy, the strengthening of ITS - Higher Technical Education (5 EQF) is one of the priorities for intervention that the Government and the Ministry of Education have included in the Education Development Plans, to accompany the growth of the Circular Economy. With funding of 1.5 billion euros, the PNRR (National Programme for Recovery and Resilience) invests in ITS to anticipate the green skills that businesses will need to support digital and green innovation in production systems. Among the economic sectors most affected by green innovation and on which education systems in Italy are strongly investing, there are:

Energy

Two of the topics of greatest productive interest are also addressed within the ITS paths: Energy production from renewable sources and management of integrated energy flows. Technological innovation and digitization can help accelerate the energy transition to a carbon neutral economy referred to in EU and international development plans. (Sustainable Development Goals ofAgenda 2030).

ITS pathways related to these 2 themes are:

Advanced technician for energy supply and plant construction

Higher technician for the management and verification of energy plants

AgriFood

Agriculture 4.0 is the result of the application of digital technologies in systems not only of harvesting automation, but also planning, improvement of production consistent with the integration and analysis of data coming directly from the fields thanks to sensors and other sources. Thanks to these new solutions and the application of digital technologies, from IoT to artificial intelligence, from big data analytics to self-driving tractors and the use of drones, farms can increase the profitability and economic, environmental and social sustainability of their business.

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The ITS paths related to the theme of Agriculture 4.0 are:

Agricultural Technician specialized in organic crops

Agricultural Technician specialized in farming systems Agriculture 4.0

Consistent with the areas of inquiry included in the research of INGENIOUS, SFC focussed on the following two areas:
1 - Overall Agriculture Management
2 - Energy Production and Management

The test group was subsequently made up of VET educators involved in the teaching of digital skills in the aforementioned areas. There were no other boundaries set in terms of public or private enterprise, experience of VET educator, employment status and so on.

1-1.2 Definition and formation of criteria and instructions for conducting a survey

SFC contacted VET Providers, enterprises, NGOs, Technical High Schools and Institutes (ITS),
In particular, the ITS involved in the survey that had expressed interest in being involved in the INGENIOUS experiment, were identified:
ITA Istituto Tecnico Agrario EMILIO SERENI https://www.agrariosereni.edu.it/
ITS Istituto Tecnico Superiore EAT Eccellenza Agroalimentare Toscana https://fondazione-eat.it/
ITS Istituto Tecnico Superiore Tech & Food https://www.itstechandfood.it/

To ensure maximum diffusion and widen the possibility of participation to the widest target audience, We published the survey on the European Commission's Electronic Platform for Adult Learning in Europe (EPALE), on social media pages of SFC and the authors.

1-1.3 Collecting and storing survey data

Collection and storage of data was managed directly on the google drive of the INGENIOUS project. Respondents used the link to the survey generated by google forms, which was disseminated as previously described, enabling for safe, reliable collection and immediate creation of graphs and charts displaying the breakdown of responses for each question in the survey.

1-2. EVALUATION OF ASSESSMENT PROCEDURES' FEEDBACK

1-2.1 Calculation of quantitative data and analysis of the information received

General information
Just under half of respondents have been teaching for more than 11 years which shows they are highly experienced.

Digital Teaching Competences
About 60% of teachers consider their digital teaching competence to be at the top 3 levels of proficiency, from B2 (expert) to C2 (pioneer). They consider themselves even more capable of digital competences such as creating contents and engagement, facilitating students' learning (70-85% at top 3 proficiency levels). So, the only competences which stand out as comparatively weak (at least half of respondents do not consider themselves at least an expert) are managing psychological aspects of communication (possibly not understanding the question, as specified by one respondent), formative and summative assessment, copyright and learning.
One emerging competence could be the use of digital skills for copyright and licensing, where 22% have no knowledge.

General Digital Greening Competences (GDGC) for sustainability
The theme continues here, educators assess their skills at the top 3 proficiency levels for most of the questions. Notable exceptions are:

AREA 1. DATA COLLECTION AND USE: for both visual design and data protection, 40% consider themselves at an elementary level or lower. The same figure applies to the use of digital tools for optimization, modelling, simulation and visualization of processes, products and services.

AREA 2: WORKFLOW MANAGEMENT FOR EFFICIENCY AND TRANSPARENCY: nearly half of respondents consider themselves at an elementary level or lower when using digital tools for risk management.

AREA 4: FINANCIAL AND LEGAL ASPECTS: 40% consider themselves at a basic level or lower when using digital tools for both accounting and procurement.

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AREA 5: RESEARCH AND DEVELOPMENT: 50% of respondents consider themselves at an elementary level or lower for greener product development and greener service development.

Specific Digital Green Competences (SDGC)
There is a more even distribution of responses in this part of the survey. Respondents have either a complete lack of knowledge or limited skills for most of the questions, in particular, for hydroponic and vertical farming, and sustainable breeding techniques.

1-2.2 Collation, comparison and systematization of information

Having only received 2 responses for the survey on Energy Production and Management, those results have been discarded from this analysis. The number of responses for the survey on Overall Agriculture Management stands at 22. This is disappointing not only because it fails to reach the project goal of 25, but also because the results have to be treated with caution considering the small sample size.
However, the respondents were specifically targeted by SFC, so we can be sure of the reliability of each answer, and this allows us to be quite confident about the results and the evidence they give in highlighting emerging competences.
A note of caution should also be added to the high levels of self-assessment regarding general digital skills. Educators have a very strong perception of their abilities here, self-assessment is of course subjective, whether their capacity to teach online would be considered at a similar level when subjected to external assessment is open for debate.
18 of the 22 respondents have been teaching for more than 7 years. Only two of the respondents have been teaching between 1-3 years. We could assume that they latter are younger and more tech-savvy, but the individual results show that although one respondent consistently rated themselves as highly proficient (at least B2) for nearly all digital and green skills, the other respondent ranked at the other end of the spectrum for nearly all survey questions. This respondent regularly stated a complete lack of knowledge for many digital and green skills with the exception of the Specific Green Digital Competence of using digital tools for microbiology and food hygiene (C2).
With a higher number of respondents, or by asking for the age of the participant, it could have been possible to establish whether younger educators are more confident in using digital tools in their instruction.

1-2.3 Generating a report with visual diagrams

As previously stated, educators assessed their digital teaching competence very highly (50% at least B2):

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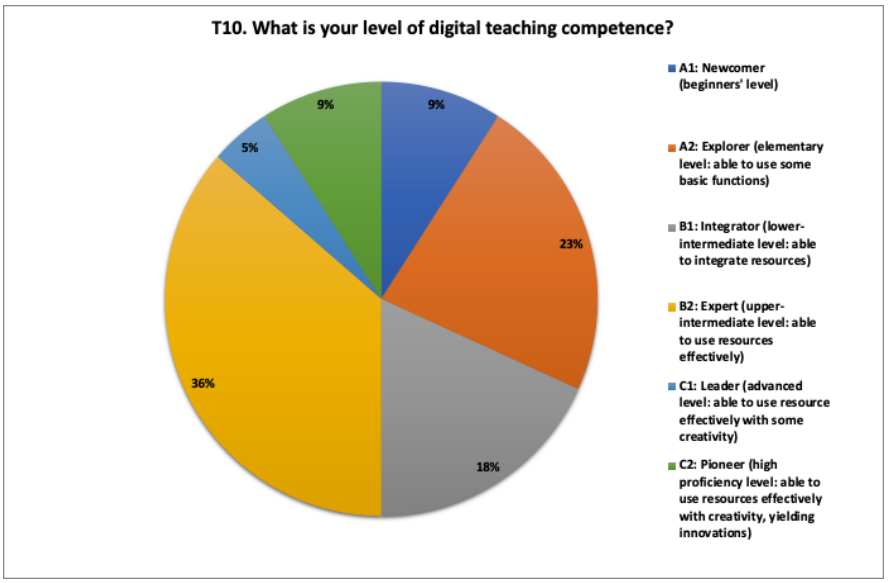
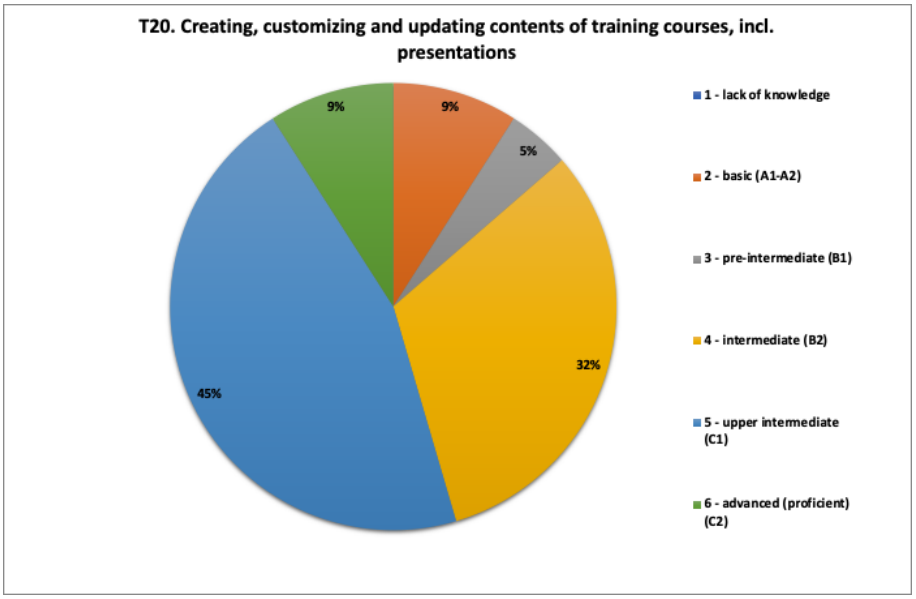
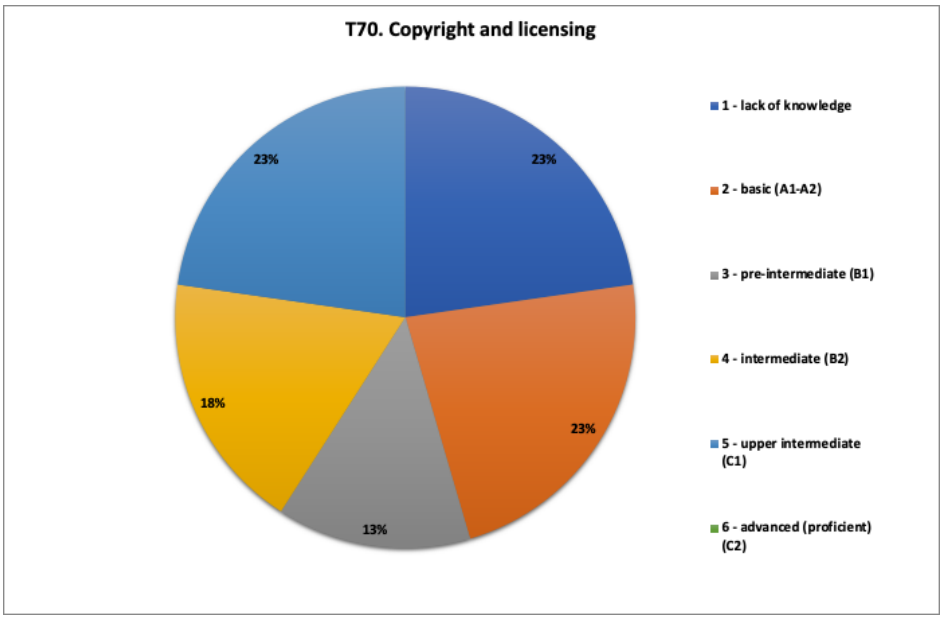


Educators were particularly strong on some of the general digital skills, such as creating course content (85% at least B2):

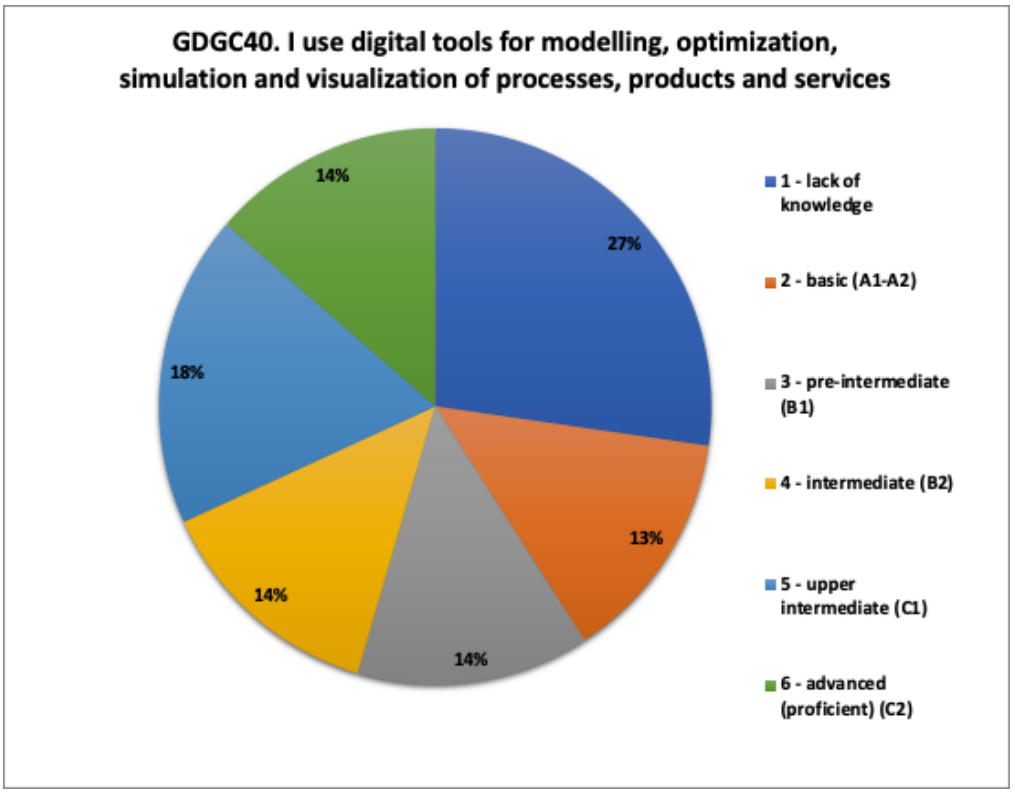


However, one emerging competence from the general digital skills could be for the use of copyright and licensing (22% lack of knowledge, more than half B1 or lower):



From among the General Digital Greening competences for sustainability, in Area 1: Data collection and use the following three charts show weaker results, with at least 40% of respondents stating they have an elementary level at best.

First, the use of digital tools for modelling, optimization, simulation and visualization of processes, products and services:



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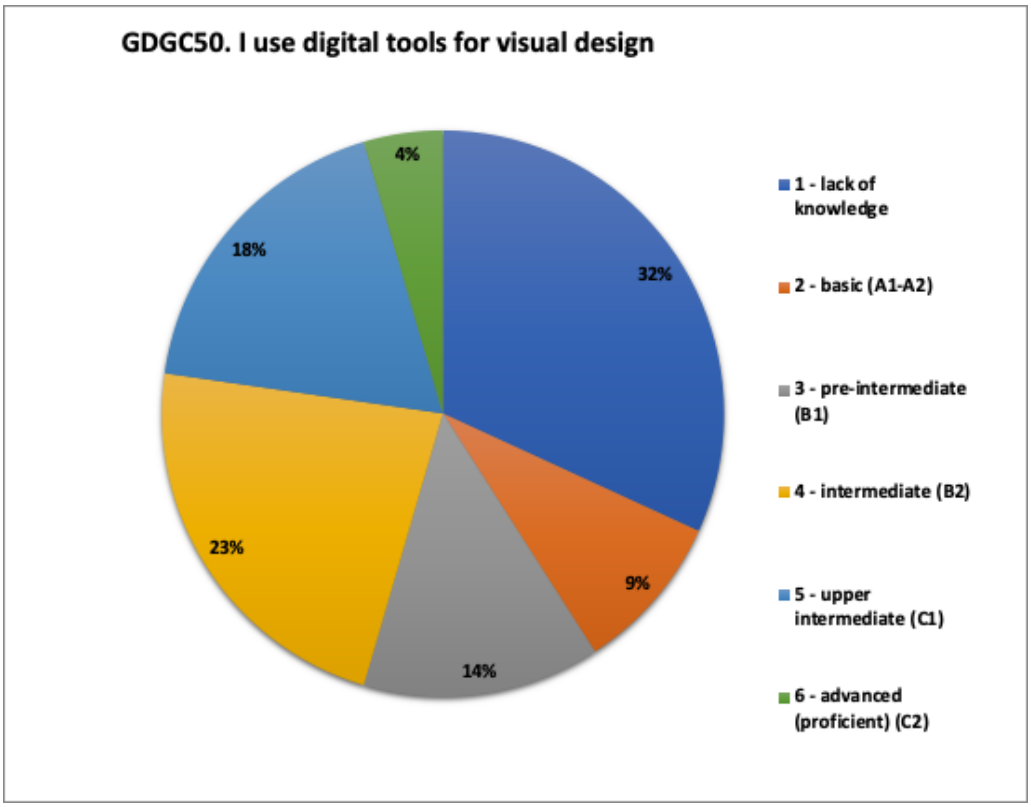
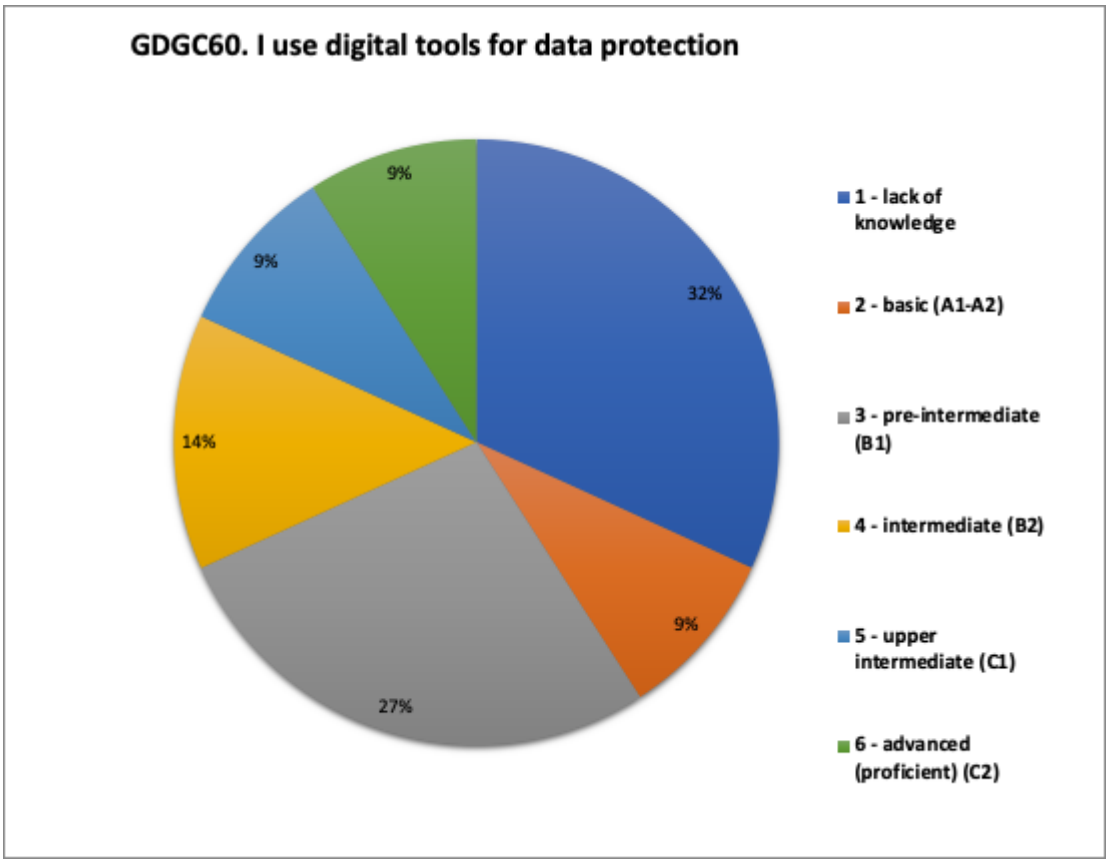
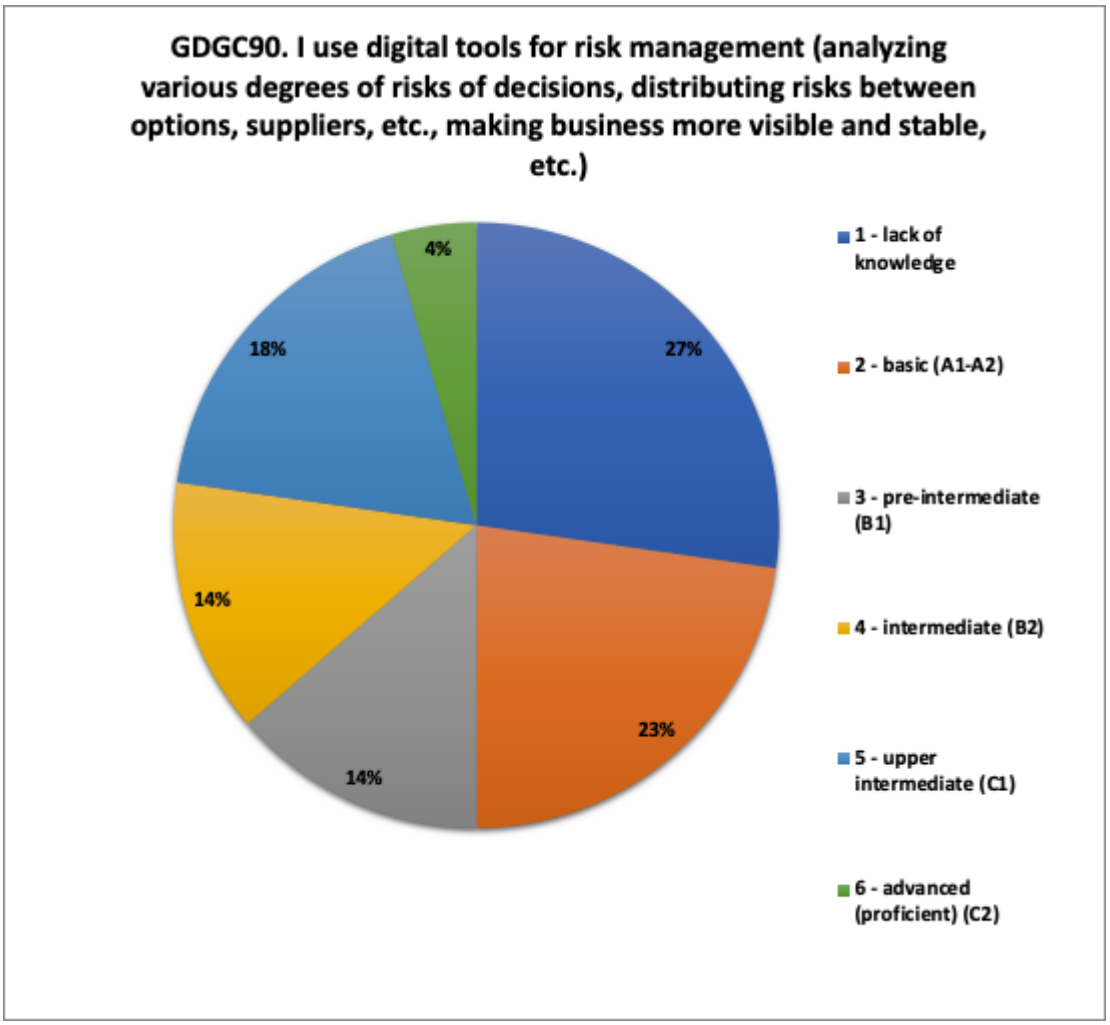
Then, using digital tools for visual design:



And finally, for data protection:

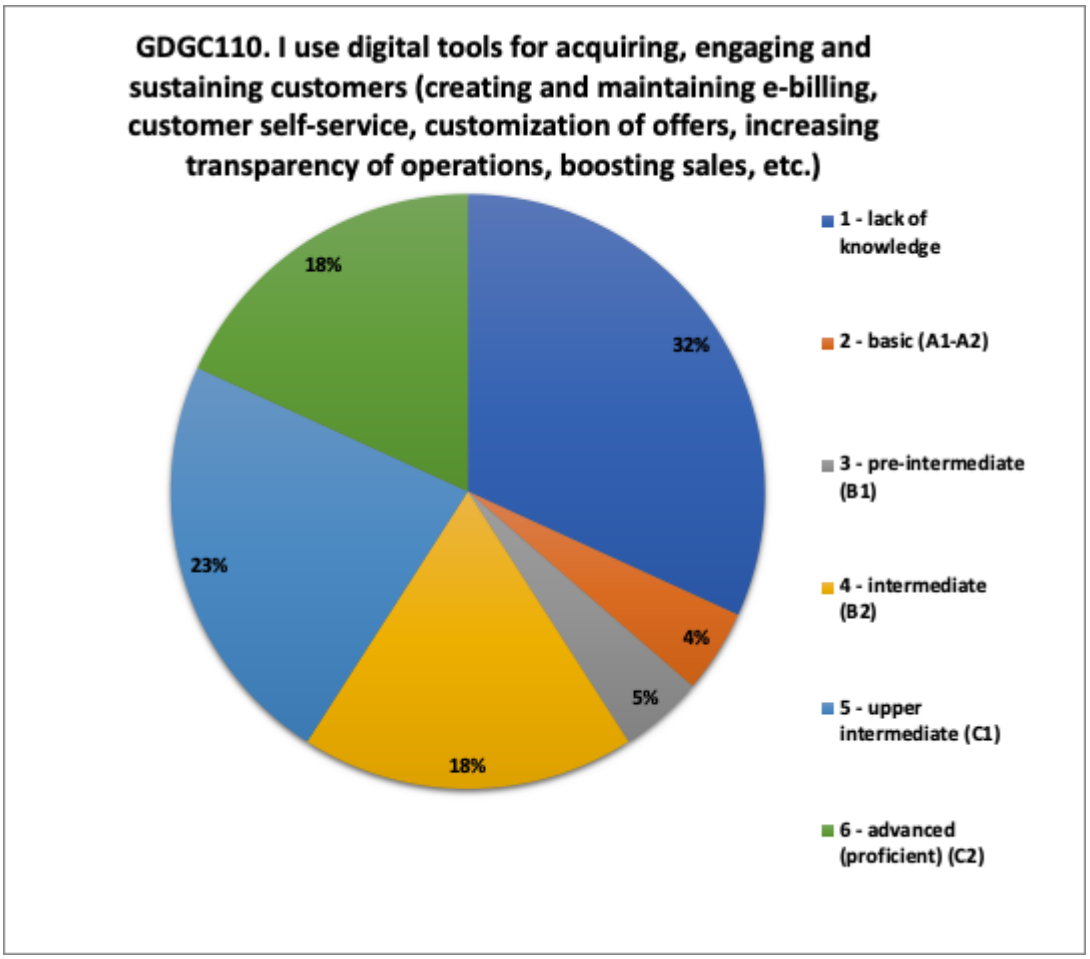


In AREA 2: WORKFLOW MANAGEMENT FOR EFFICIENCY AND TRANSPARENCY only the use of digital tools for risk management could be considered as an emerging competence for IO2:

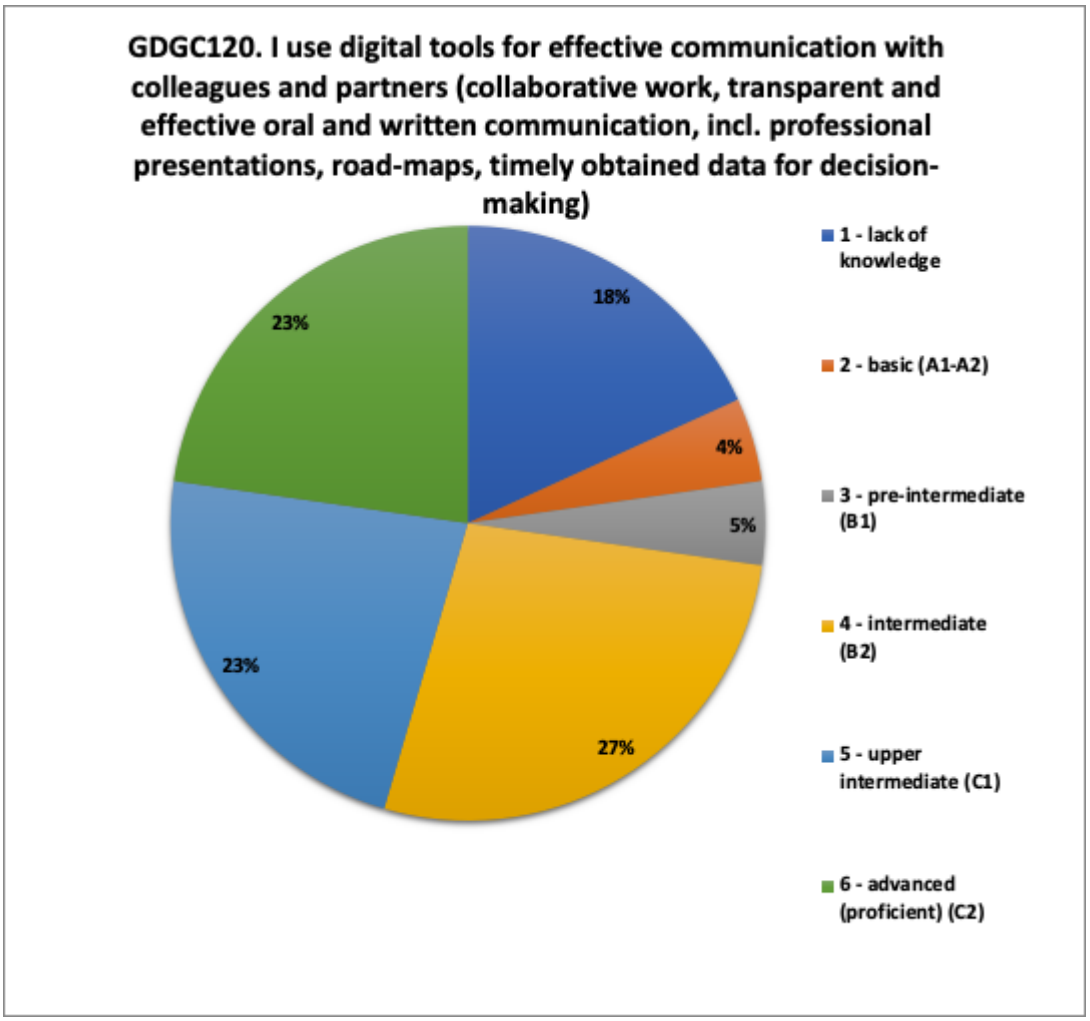


In AREA 3: COMMUNICATION the results show high competence:

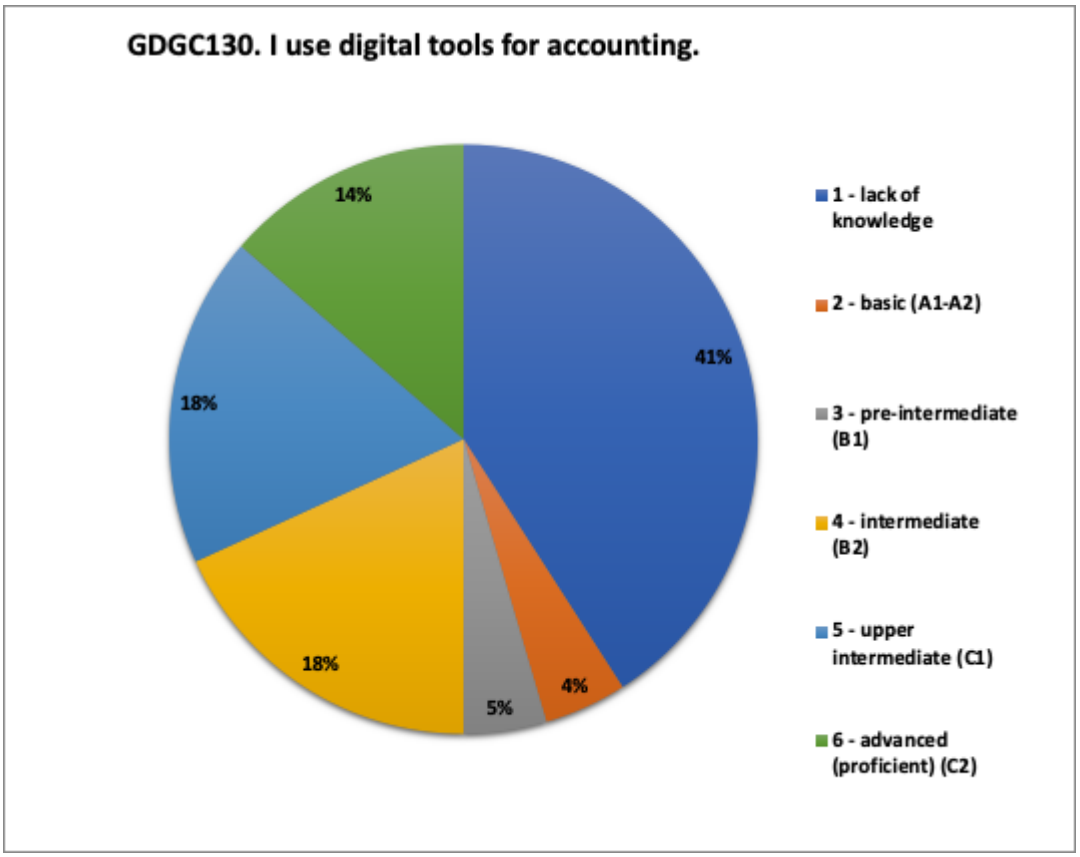
Communication with customers shows 5 respondents with a complete lack of knowledge, implying it's not part of their role:



Whereas communicating with colleagues and partners is particularly high:



In AREA 4: FINANCIAL AND LEGAL ASPECTS, the following two charts show the lack of skills in first, accounting and then, procurement:



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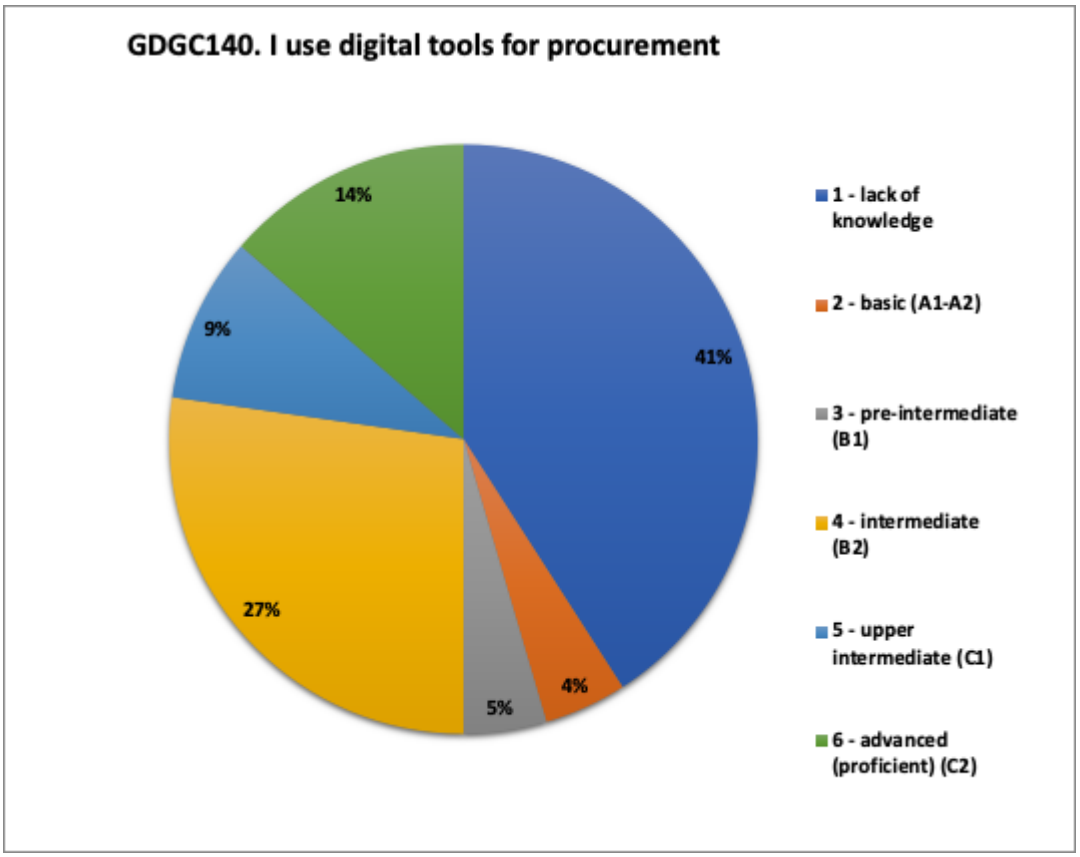
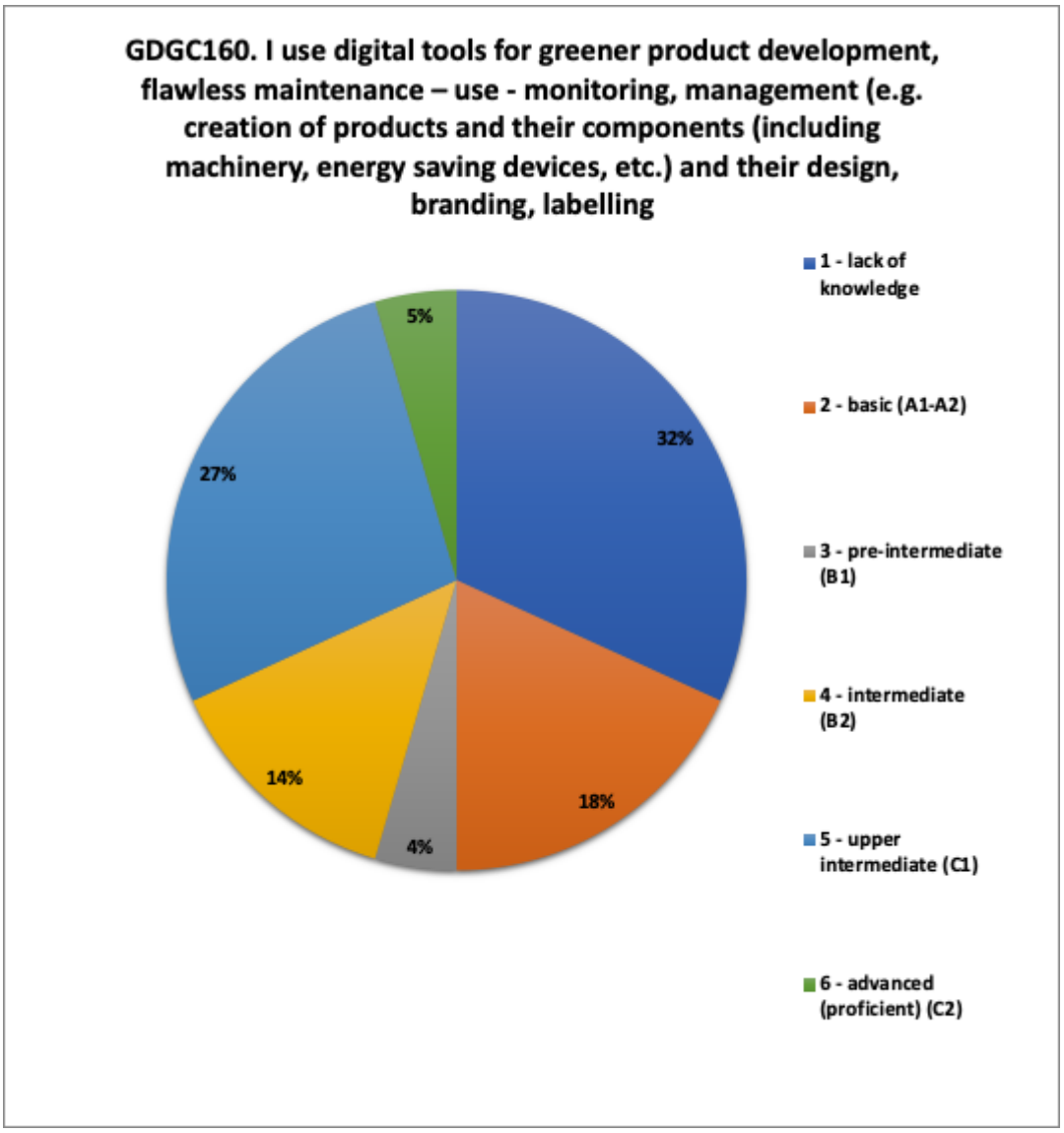
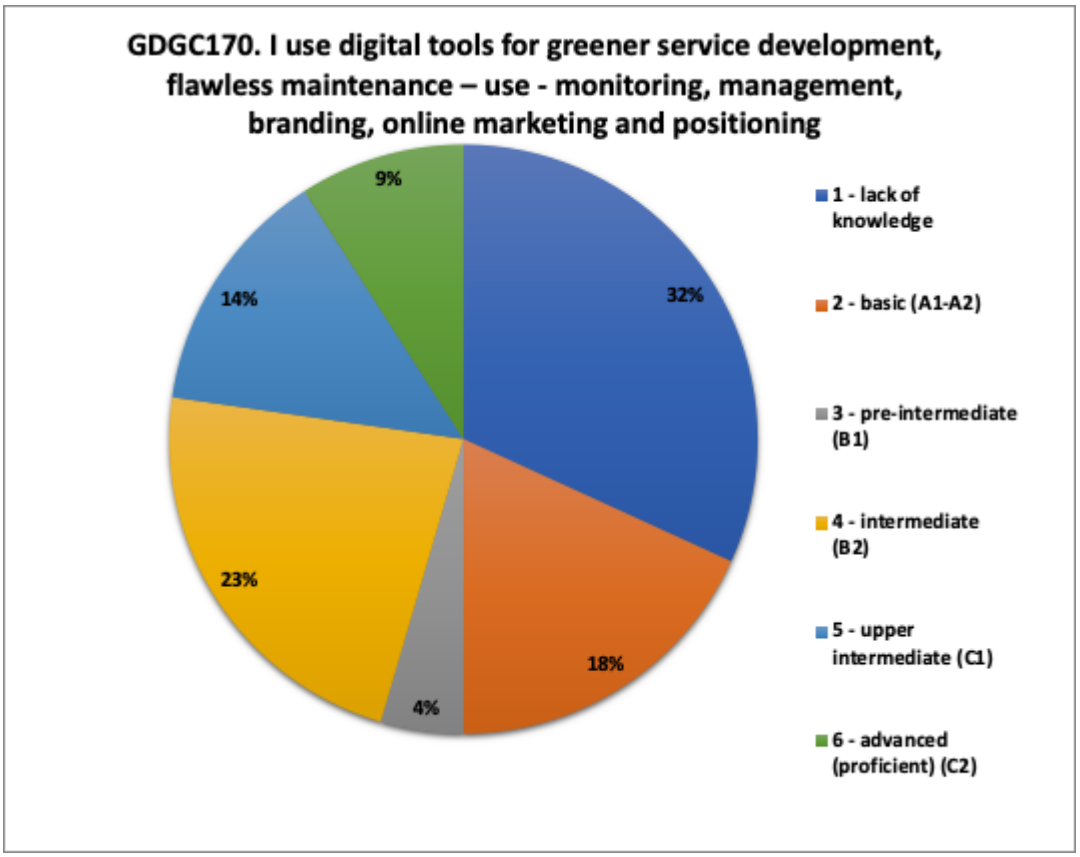


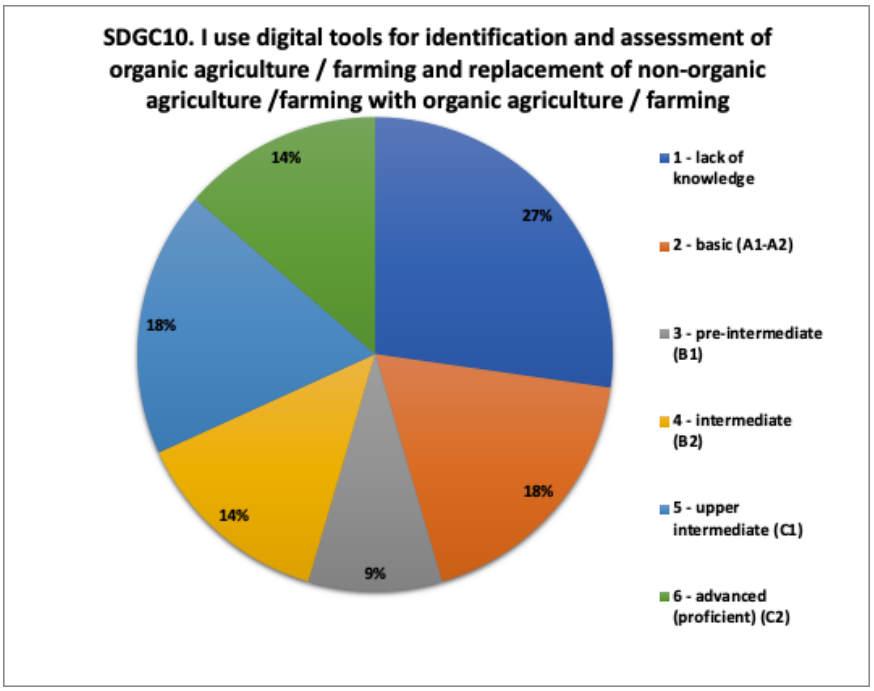
In AREA 5: RESEARCH AND DEVELOPMENT, again two of the questions stand out as identifying possible emerging competences for INGENIOUS. 50% of respondents consider themselves at an elementary level or lower for greener product development and greener service development:

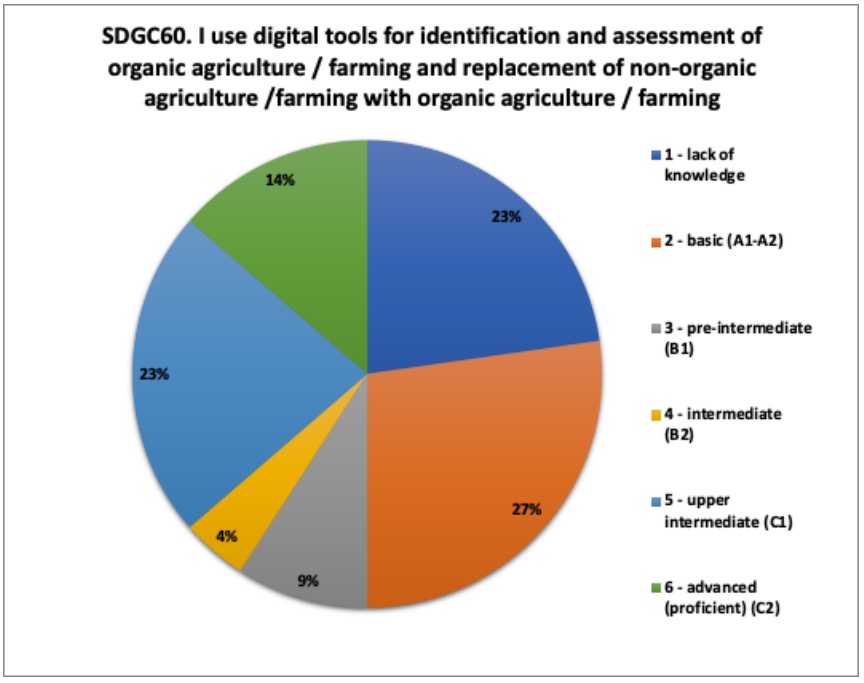

GDGC160. I use digital tools for greener product development, flawless maintenance – use - monitoring, management (e.g. creation of products and their components (including machinery, energy saving devices, etc.) and their design, branding, labelling
32%
18%
4%
14%
27%
5%
1 - lack of knowledge
2 - basic (A1-A2)
3 - pre-intermediate (B1)
4 - intermediate (B2)
5 - upper intermediate (C1)
6 - advanced (proficient) (C2)



Regarding the Specific Digital Green Competences, the first question is on the use of digital tools for identification and assessment of organic agriculture / farming and replacement of non-organic agriculture /farming with organic agriculture / farming.

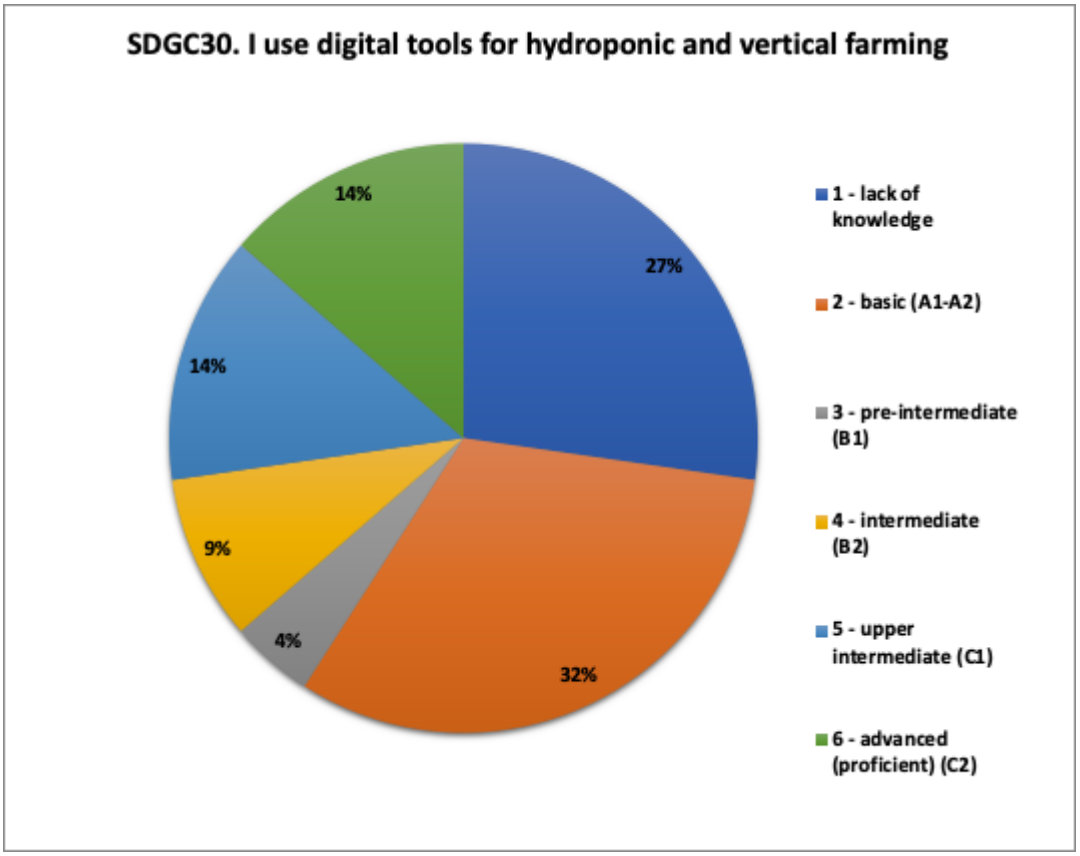
This is a control question to check consistency of answers, so 5 questions later it is repeated, and we get broadly similar results with a slight variation:


SDGC10. I use digital tools for identification and assessment of organic agriculture / farming and replacement of non-organic agriculture /farming with organic agriculture / farming
14%
27%
18%
18%
14%
9%
1 - lack of knowledge
2 - basic (A1-A2)
3 - pre-intermediate (B1)
4 - intermediate (B2)
5 - upper intermediate (C1)
6 - advanced (proficient) (C2)

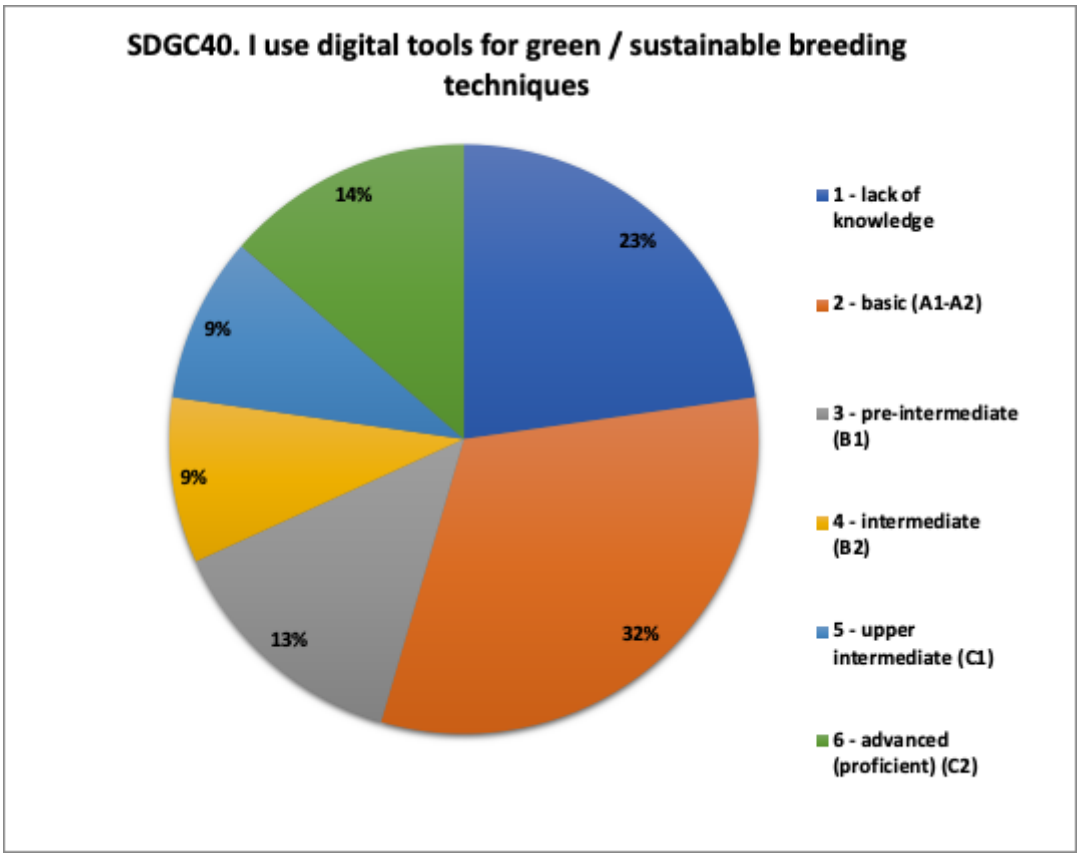

SDGC60. I use digital tools for identification and assessment of organic agriculture / farming and replacement of non-organic agriculture /farming with organic agriculture / farming
14%
23%
23%
4%
27%
9%
1 - lack of knowledge
2 - basic (A1-A2)
3 - pre-intermediate (B1)
4 - intermediate (B2)
5 - upper intermediate (C1)
6 - advanced (proficient) (C2)

The weakest competences in this section were from the following two questions:

First, for the use of digital tools for hydroponic and vertical farming:



And then in the use of digital tools for green/sustainable breeding techniques:



In conclusion, we can say that there are areas for development in all areas covered by the survey. Even allowing for the assumed fact that educators have overestimated their skills and competences, especially in the first parts of the survey, there are still emerging competencies to explore in IO2. Taking these results alongside interviews and debates conducted with SFC stakeholders, we can consider the educators as highly experienced for the most part, and confident with their general digital teaching skills. Even from the weakest results in the weakest part of the survey responses, Specific Digital Green Competences, about a third of respondents consistently consider themselves as highly skilled educators here.

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However, a teacher from one of the technical institutes confirmed to us that the teacher's approach to digital tools is polarized: there are technical profiles who never studied teaching, and they are digitally capable for agriculture 4.0 whereas professional teachers have a lower digital profile in both fields of application: teaching and working.

APPENDICES

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1. Survey aim and justification

The aim of the survey was to assess greening and green digital skills of VET instructors. The following reasons justified the aim: to determine the readiness of VET staff for teaching online, to identify gaps in VET skills for further professional development, to recruit properly qualified VET staff, to assess VET instructors' professional and teaching competences, to design new courses on circular economy and specific green courses developing general greening competences and specific green competences of students through the spreading activation processes from teaching-to-student, etc.

2. Survey design

The survey was designed on a set of courses administered by VET instructors in Greece, Italy, Bulgaria and Slovenia (table 1).

Table 1. Countries and course descriptions

Country	Institution	Courses
Italy	Higher Technical Institute "Territory Energy Building Foundation"	Energy Supply
	Higher Technical Institute "Territory Energy Building Foundation"	Waste Management
	High Technician Institute "Ignazio Calvi"	Agri Food Systems
Slovenia	University of Maribor	Ecology Problems of Vehicle and Internal Combustion Engines
		Sensible Use of Energy
		Technological and Waste Waters
	University of Nova Gorica	Environment and Agriculture
		Environmental Impact Assessment

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		Land Ecosystems
		Environmentally Friendly Technologies
	Environment Protection College	Waste Management
		Rational Energy Use
		Development of Sustainable Products, Services and Processes
		Waste Water Treatment
Bulgaria	Cleantech Bulgaria	Waste Management in the Construction Industry
	Cleantech Bulgaria	Transition towards Circular Economy as a New Business Opportunity

Almost all course descriptions contained skills, knowledge and competences that could be applied to any course and any profession, on the one hand, and on the other hand, courses that were specific to the given course and profession. The former courses laid the foundation for competences labelled as *general greening digital competences*, whereas the latter courses provided the information on *specific green digital competences*. These different types of competences were introduced into two separate sections of the survey – Sections 4 and 5, respectively, bearing identical labels. Section 4 "General Greening Digital Competences" was partly consistent with the European framework "Digital Competences" (DigComp), which was designed for commercial applications.

The survey contained also other sections. Section 1 provided general information on the survey, such as the survey goal and data processing information. Section 2 collected general information on participants, such as their work experience and country of teaching. Section 3 focused on obtaining general information on teaching competences. This section was designed by integrating general provisions of the European framework "Digital Competences for Educators" (DigCompEdu) and the obtained course descriptions.

The summary of the survey blocks is provided in table 2.

Table 2. Survey blocks

Block #	Block title	Block areas	Number of questions

Section 1	General information about the survey	• Survey goal • Data privacy statement	0
Section 2	General questions about you	• Work experience	4
Section 3	Teaching digital competences	• Designing the teaching content • Creating engagement with students and colleagues • Facilitating students' independent learning • Communication • Assessment • Copyright and licensing	7
Section 4	General digital greening competences for sustainability	• Data collection and use • Work flow management for efficiency and transparency • Communication • Financial and legal aspects • Research and development	20
Section 5	Specific digital green competences	• Overall agriculture management • Supply chain and transport, including drones • Manufacturing • Energy production and management • Reducing pollution and negative effects of climate change • Use of resources (water management, waste management, management of integrated resources, management of recycled materials, land and soil management)	49

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The answers were collected via the multiple choice or Linkert scale questions. The Linkert scale questions ranged from 1 to 5 and 0 to 6 and were aligned with the level of competences (table 3).

Range of competence levels	
1 - 5	**0 - 6**
1 - lack of knowledge	0 – lack of knowledge
2 - basic (A1-A2)	1 – basic (A1)
3 - pre-intermediate (B1)	2 - elementary (A2)
4 - intermediate (B2)	3 - pre-intermediate (B1)
5 - upper intermediate (C1)	4 - intermediate (B2)
6 - advanced (proficient) (C2)	5 - upper intermediate (C1)
	6 - advanced (proficient) (C2)

3. Design of country-specific questionnaires

Since some questions of the survey were irrelevant to the needs of some countries, institutions and courses, each participant selected a set of questions for their unique course requirements. This resulted in shorter questionnaires. Each questionnaire contained all information and questions from Sections 1-3. These were Sections 4 and 5 that were not used in full. The resulted questionnaires were translated into local languages., whereas the master copy was translated into Latvian. More information on country-specific questionnaires and their results is available in country-specific appendices.

4. Roles of participating institutions in the survey

To represent the European scale of responses, a set of countries, represented by specific institutions, created and administered the survey (table 1).

Country	Institution	Responsibilities

Latvia	Transport and Telecommunication Institute	Creation of the surveys, translation of the surveys into Latvian
Greece	University of Ioannina	Reviewer of the surveys, translation of the surveys into Greek, administration of the selected surveys to VET instructors
Italy	Sistemi Formativi Confindustria	Reviewer of the surveys, translation of the surveys into Italian, administration of the selected surveys to VET instructors
Bulgaria	Cleantech Bulgaria	Reviewer of the surveys, translation of the surveys into Bulgarian, administration of the selected surveys to VET instructors
Slovenia	Styrian Technology Park	Reviewer of the surveys, translation of the surveys into Slovenian, administration of the selected surveys to VET instructors

APPENDIX II. Result data of surveys

- Excel files of surveys Please see attached excel file with timestamp and individual responses
- Tables and charts from Google.Drive surveys On the following pages
- Charts, diagrams, etc., displaying the analysis of results from section 1.2. See above

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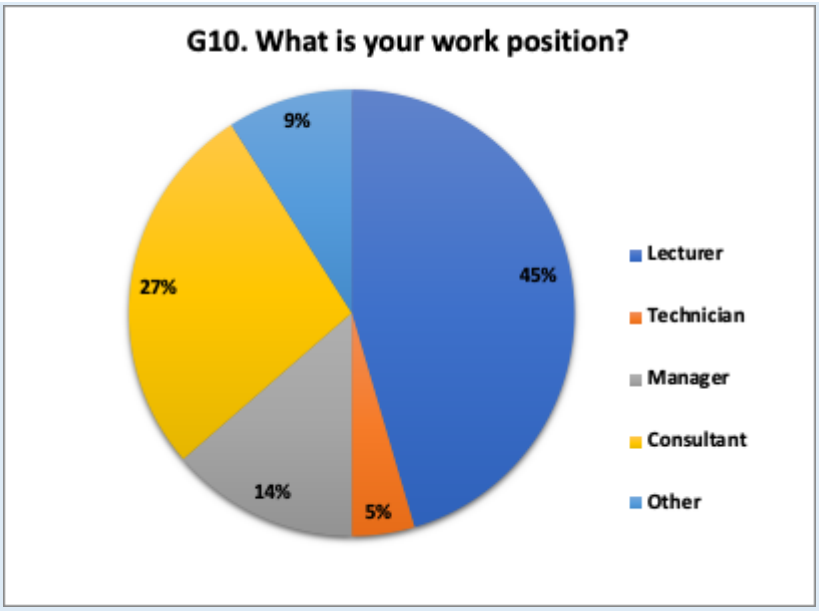

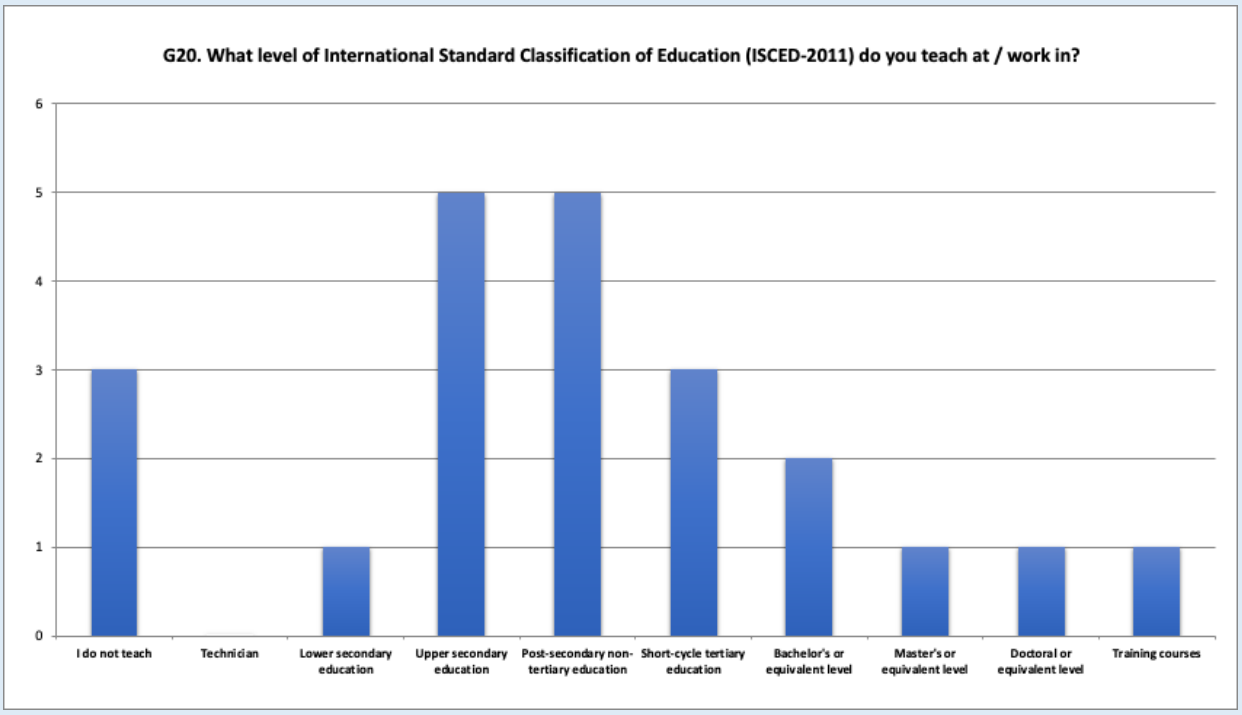

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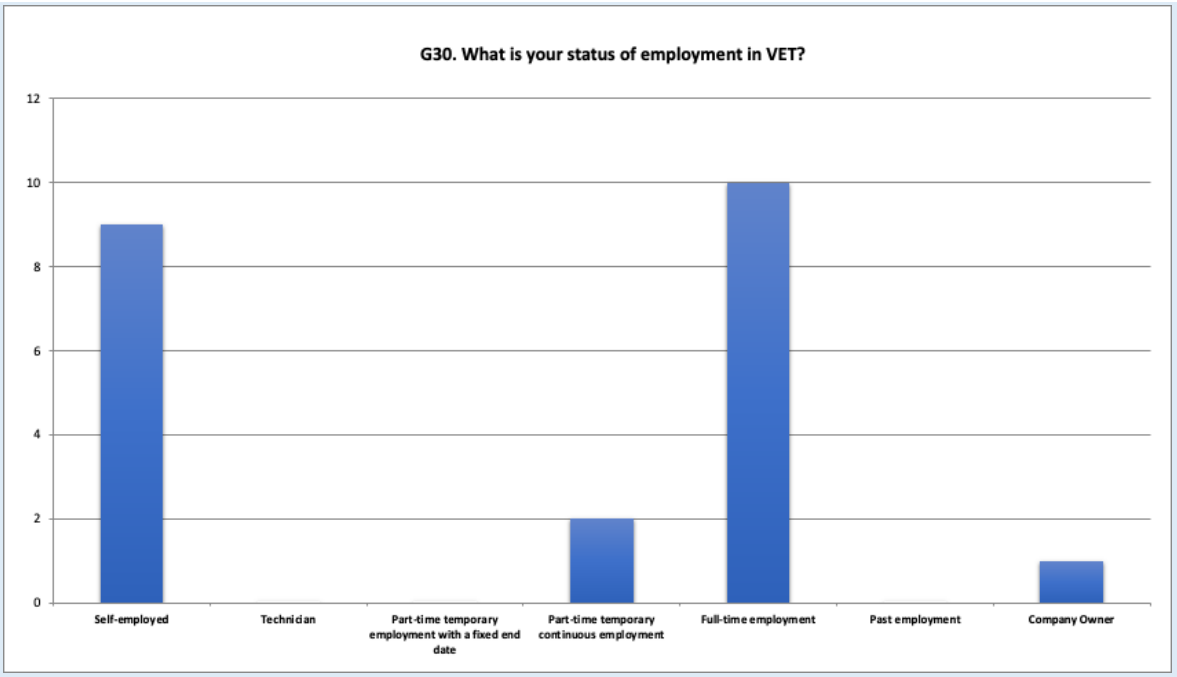

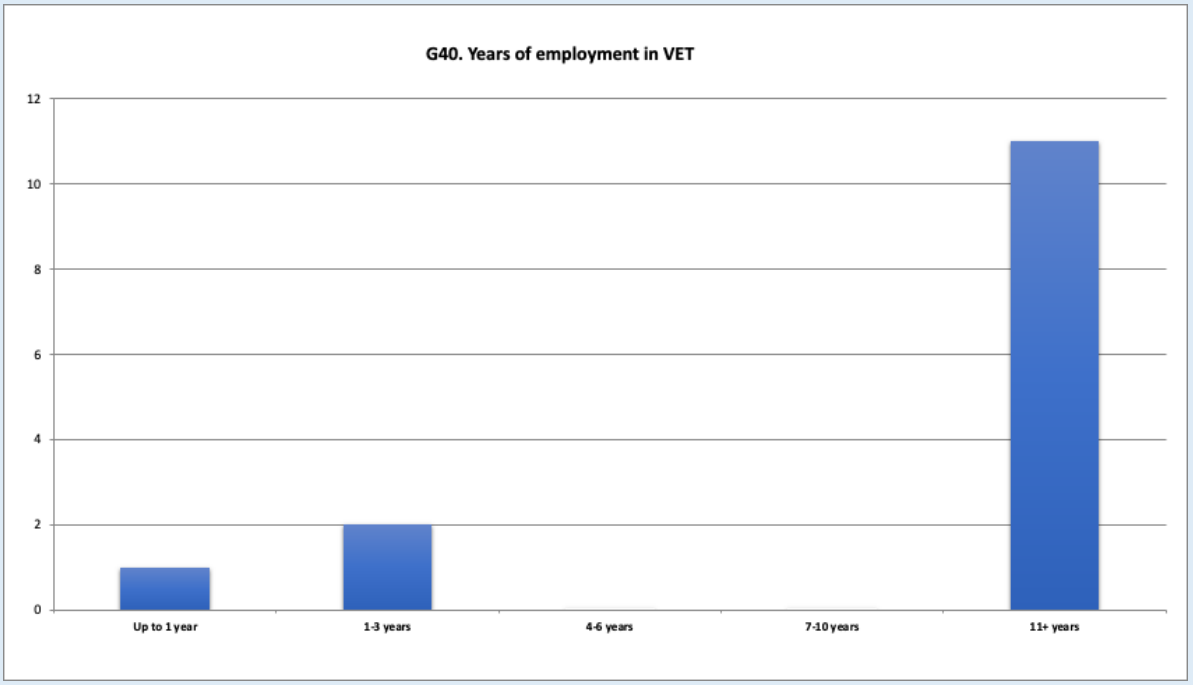

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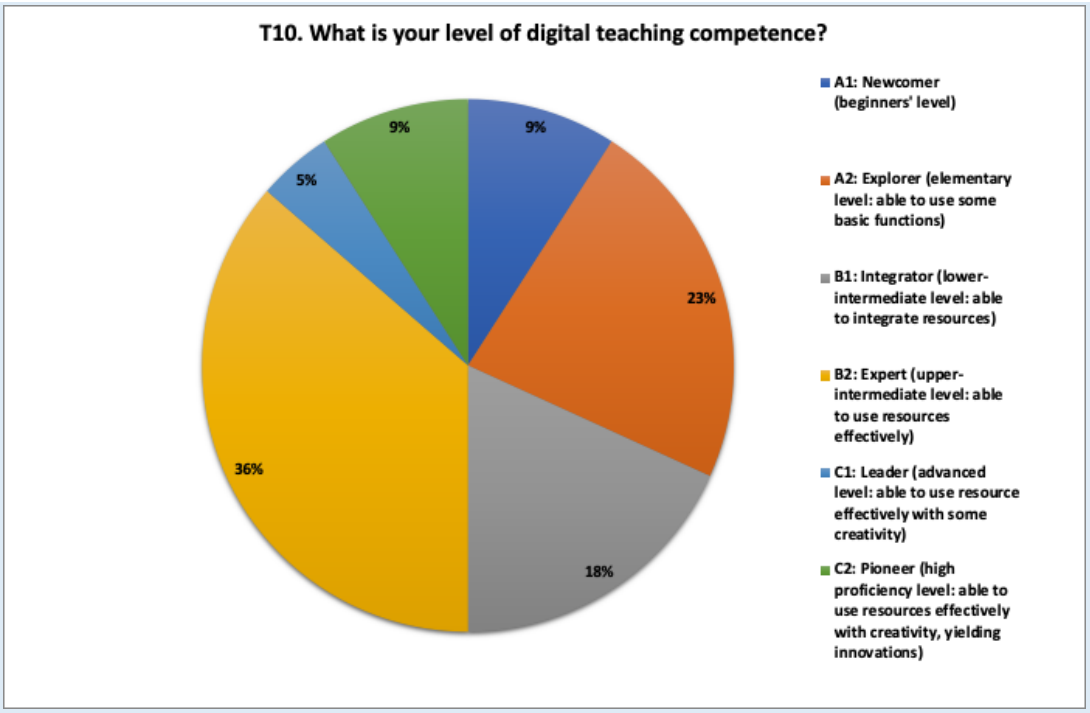

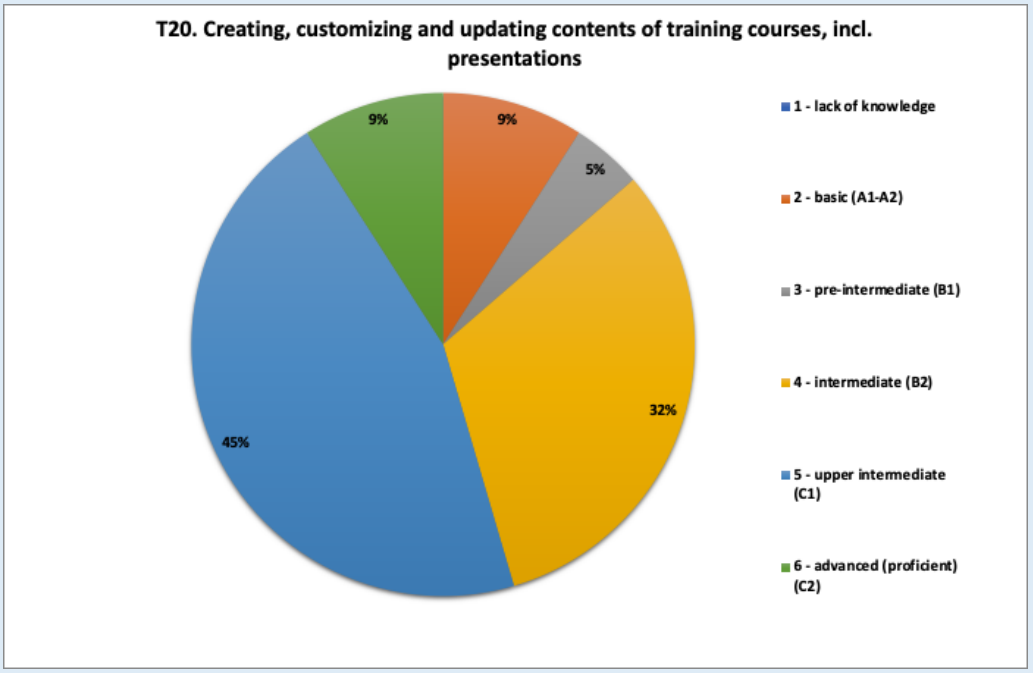

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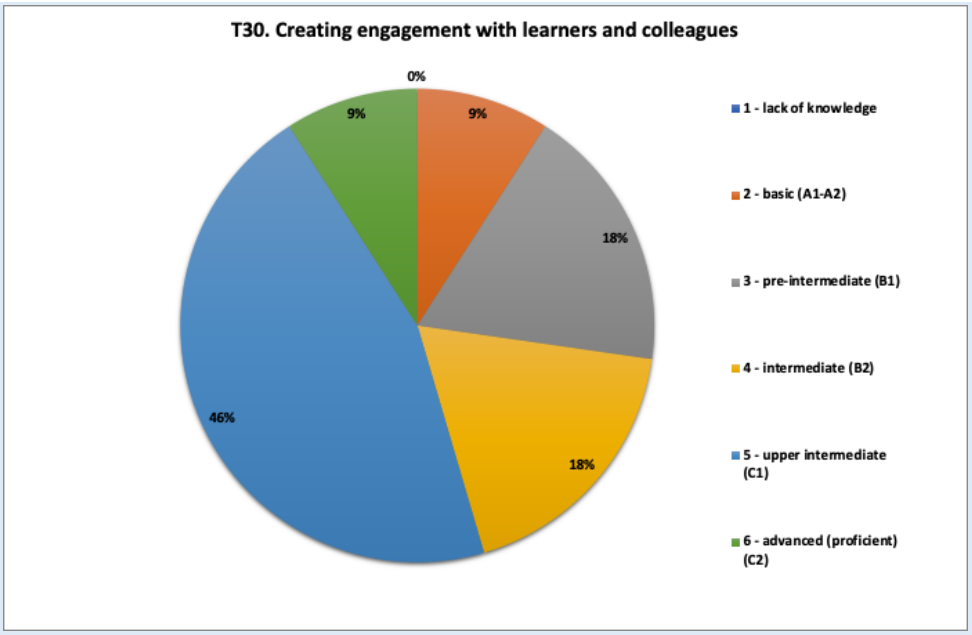
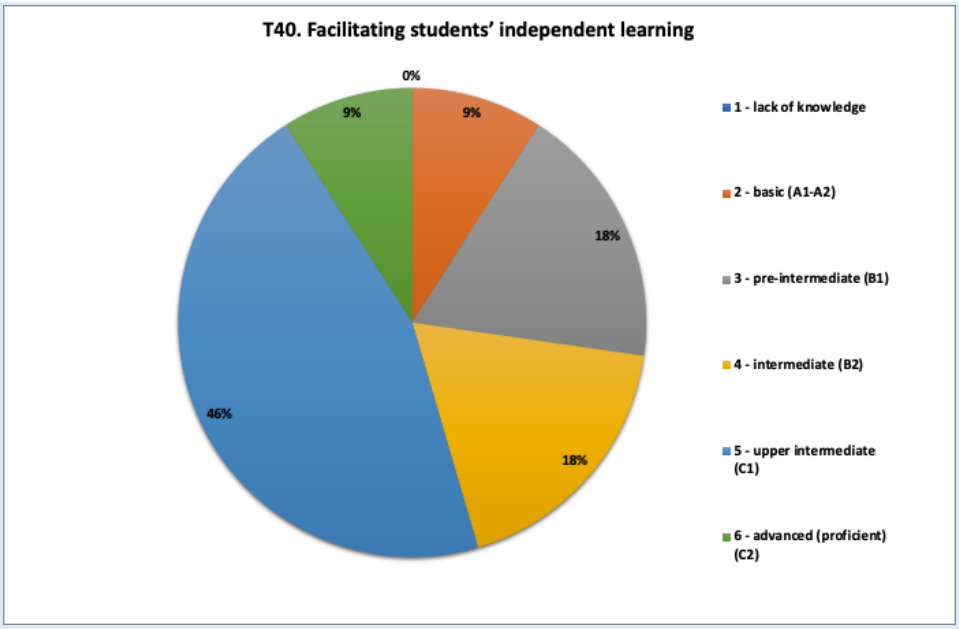
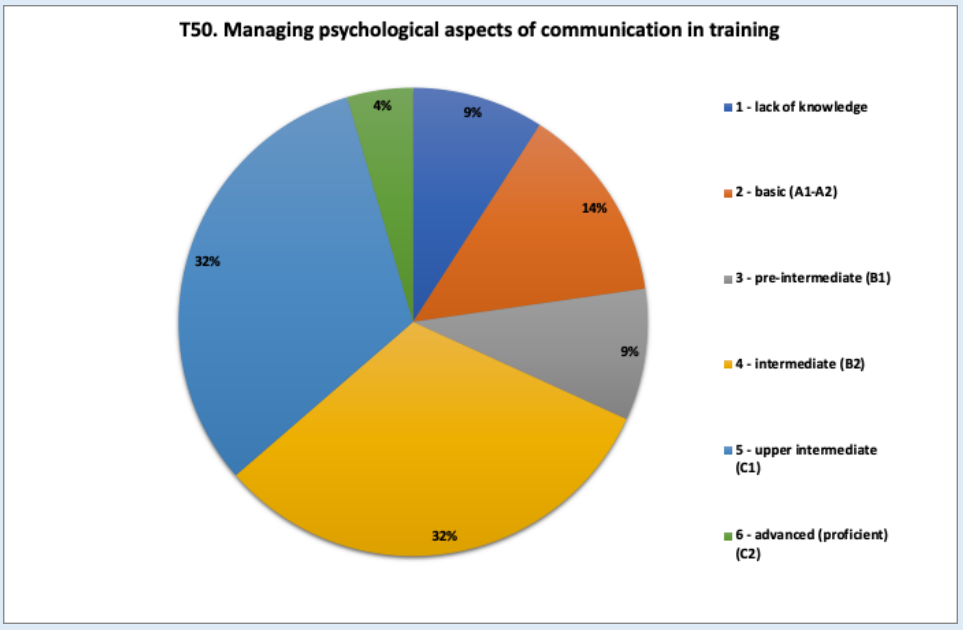
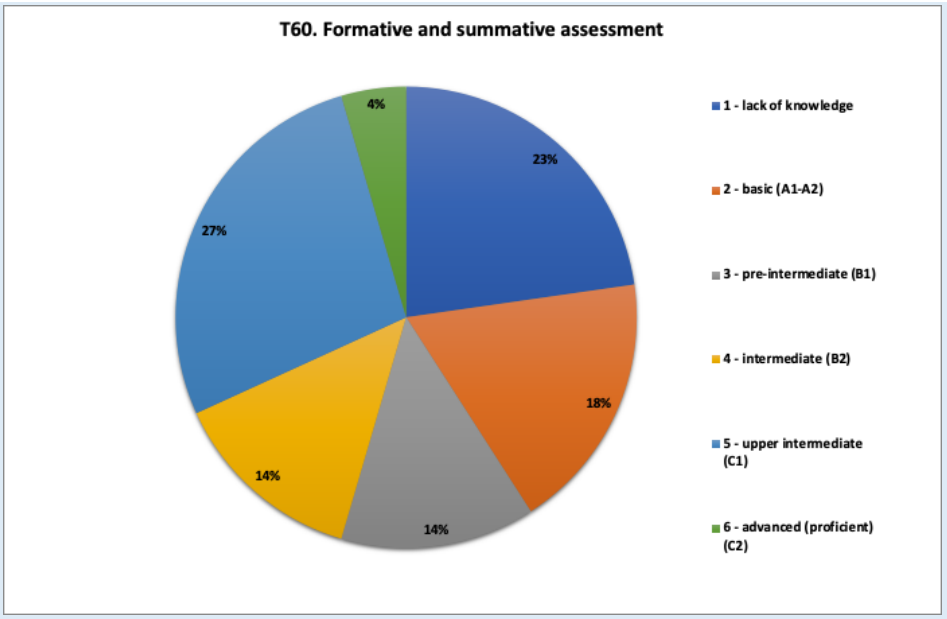
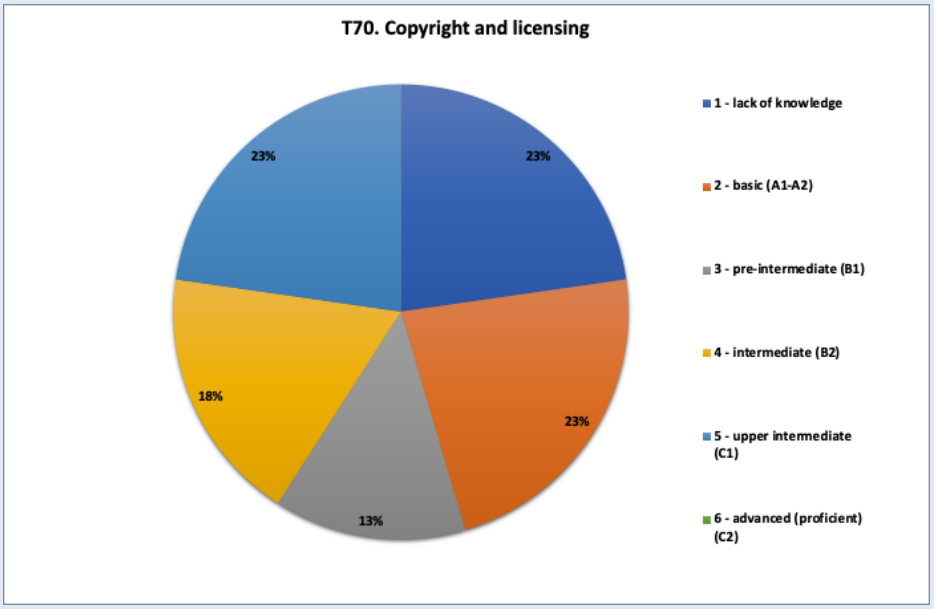

T30. Creating engagement with learners and colleagues
0%
9%
9%
18%
18%
46%
1 - lack of knowledge
2 - basic (A1-A2)
3 - pre-intermediate (B1)
4 - intermediate (B2)
5 - upper intermediate (C1)
6 - advanced (proficient) (C2)


T40. Facilitating students' independent learning
0%
9%
9%
18%
18%
46%
1 - lack of knowledge
2 - basic (A1-A2)
3 - pre-intermediate (B1)
4 - intermediate (B2)
5 - upper intermediate (C1)
6 - advanced (proficient) (C2)


T50. Managing psychological aspects of communication in training
4%
9%
14%
32%
9%
32%
1 - lack of knowledge
2 - basic (A1-A2)
3 - pre-intermediate (B1)
4 - intermediate (B2)
5 - upper intermediate (C1)
6 - advanced (proficient) (C2)





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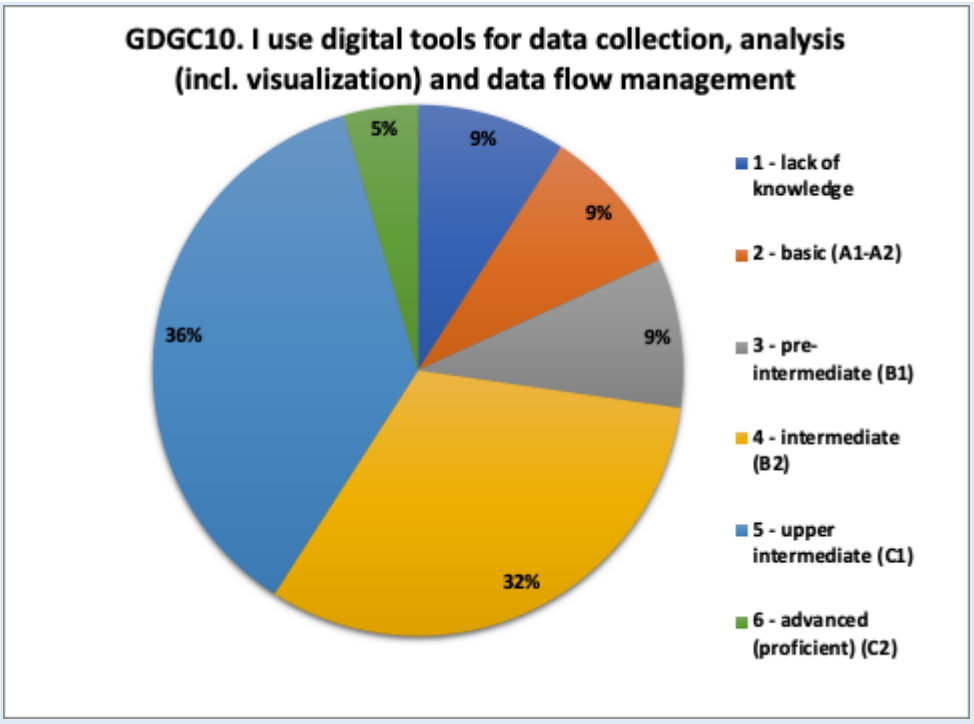

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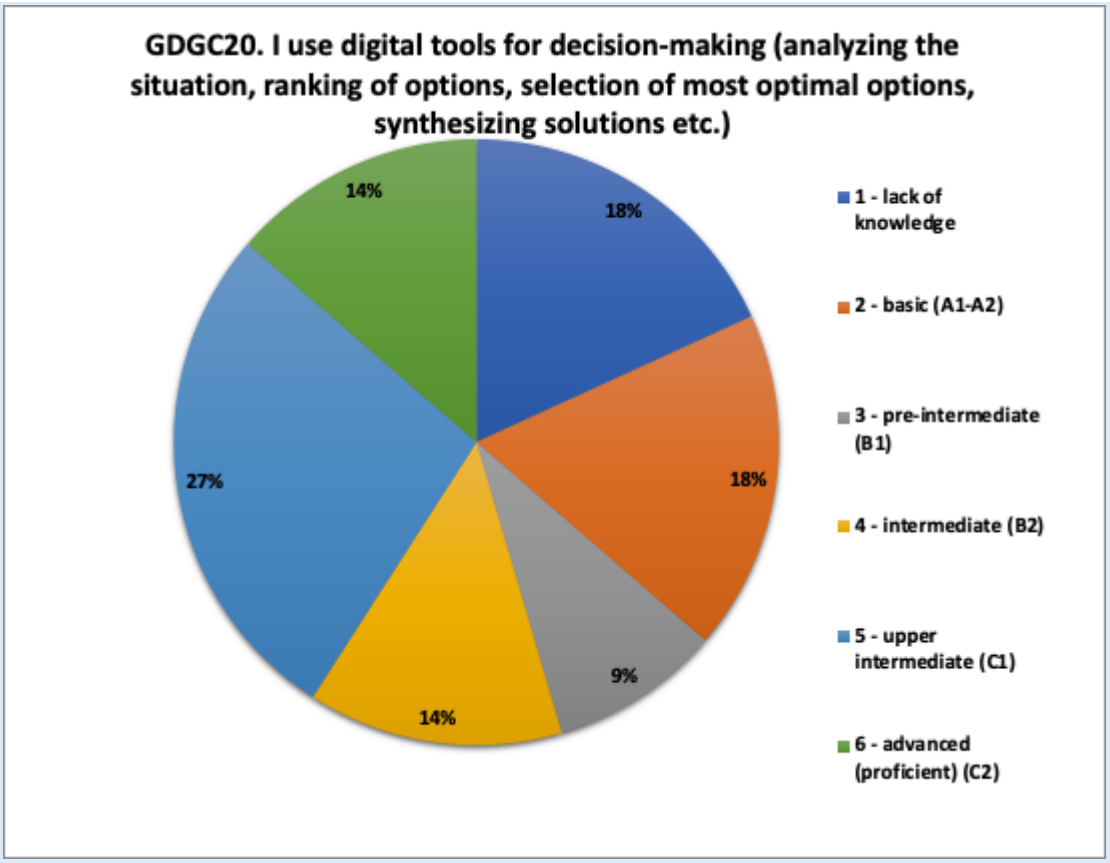

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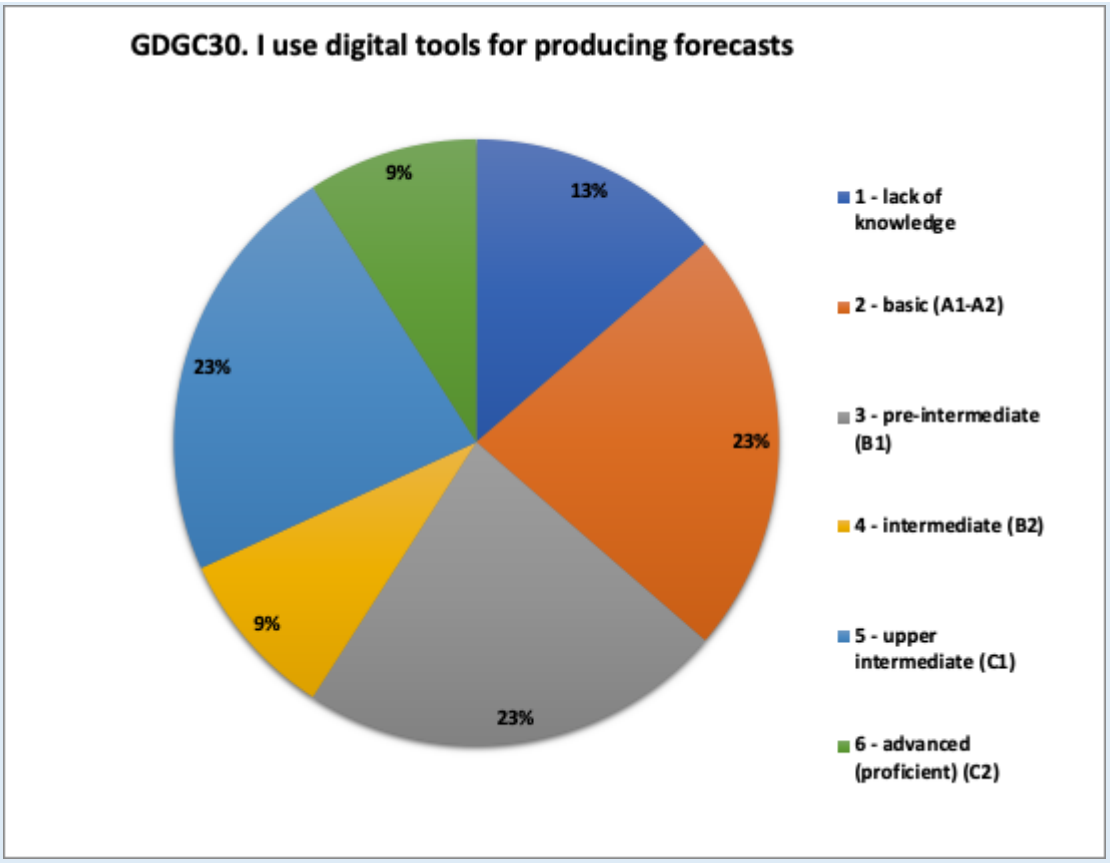

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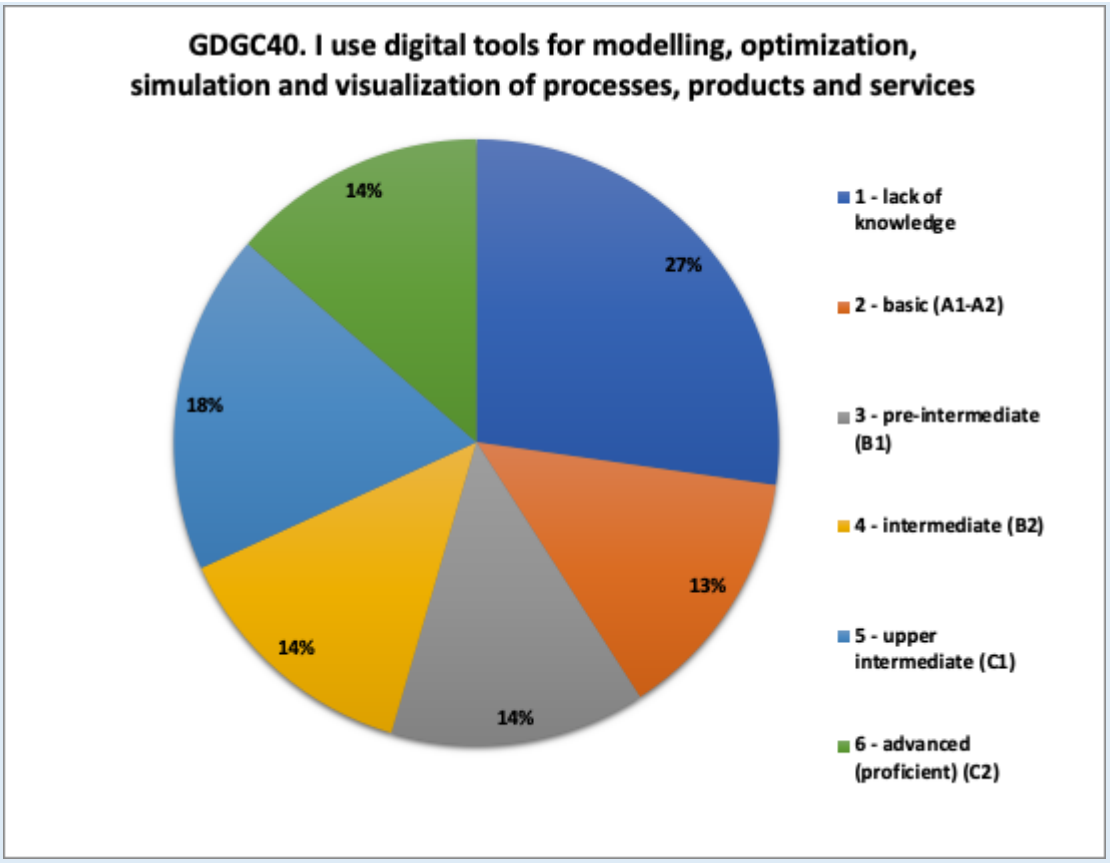

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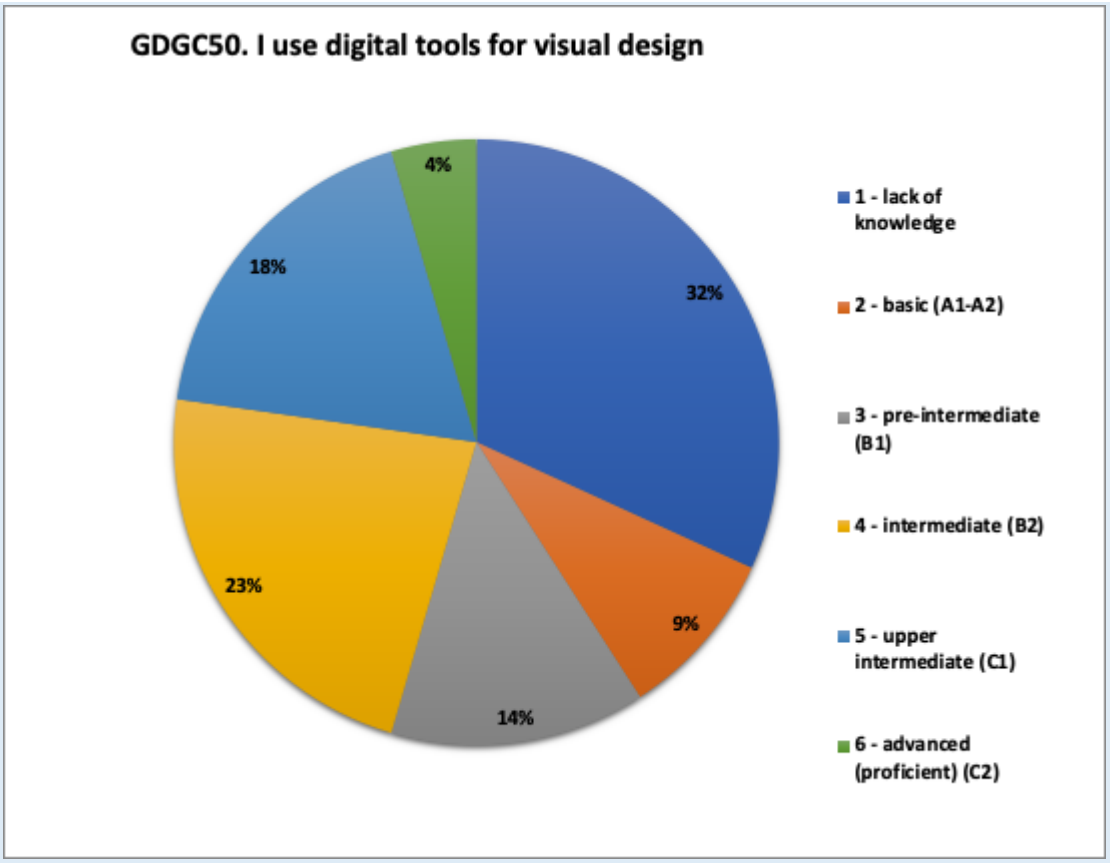

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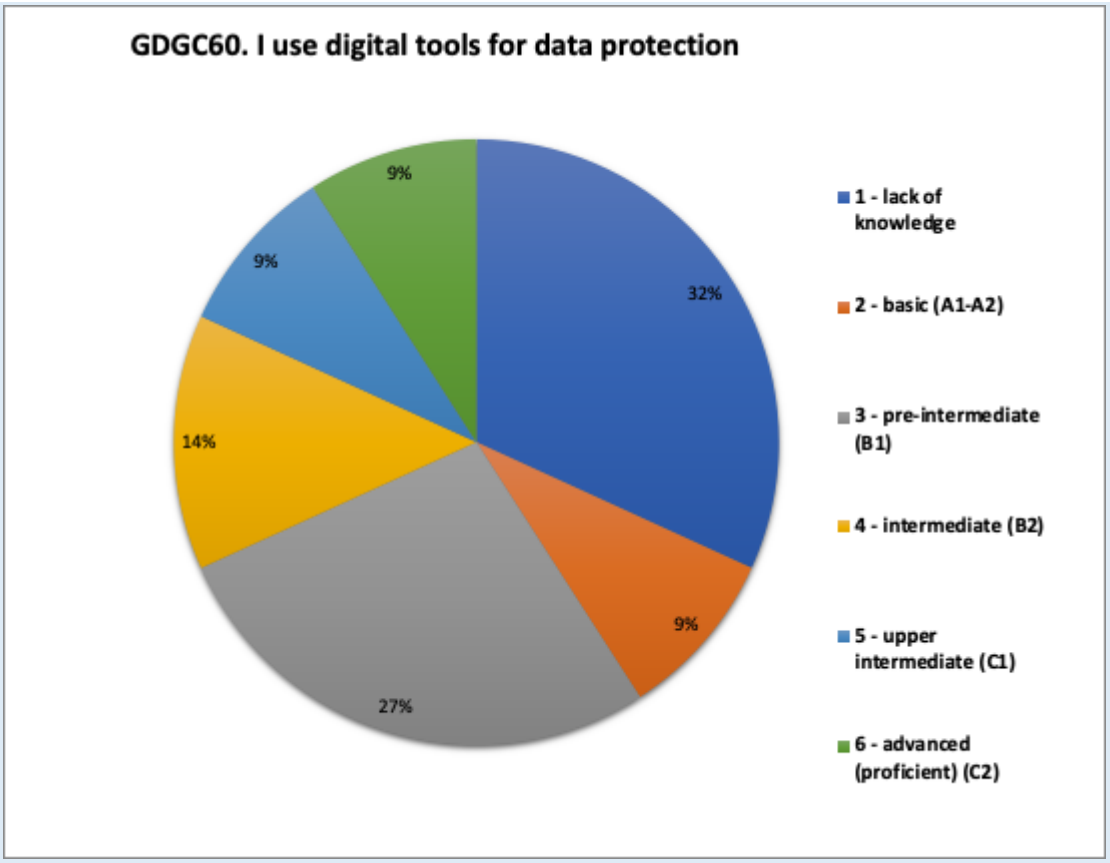

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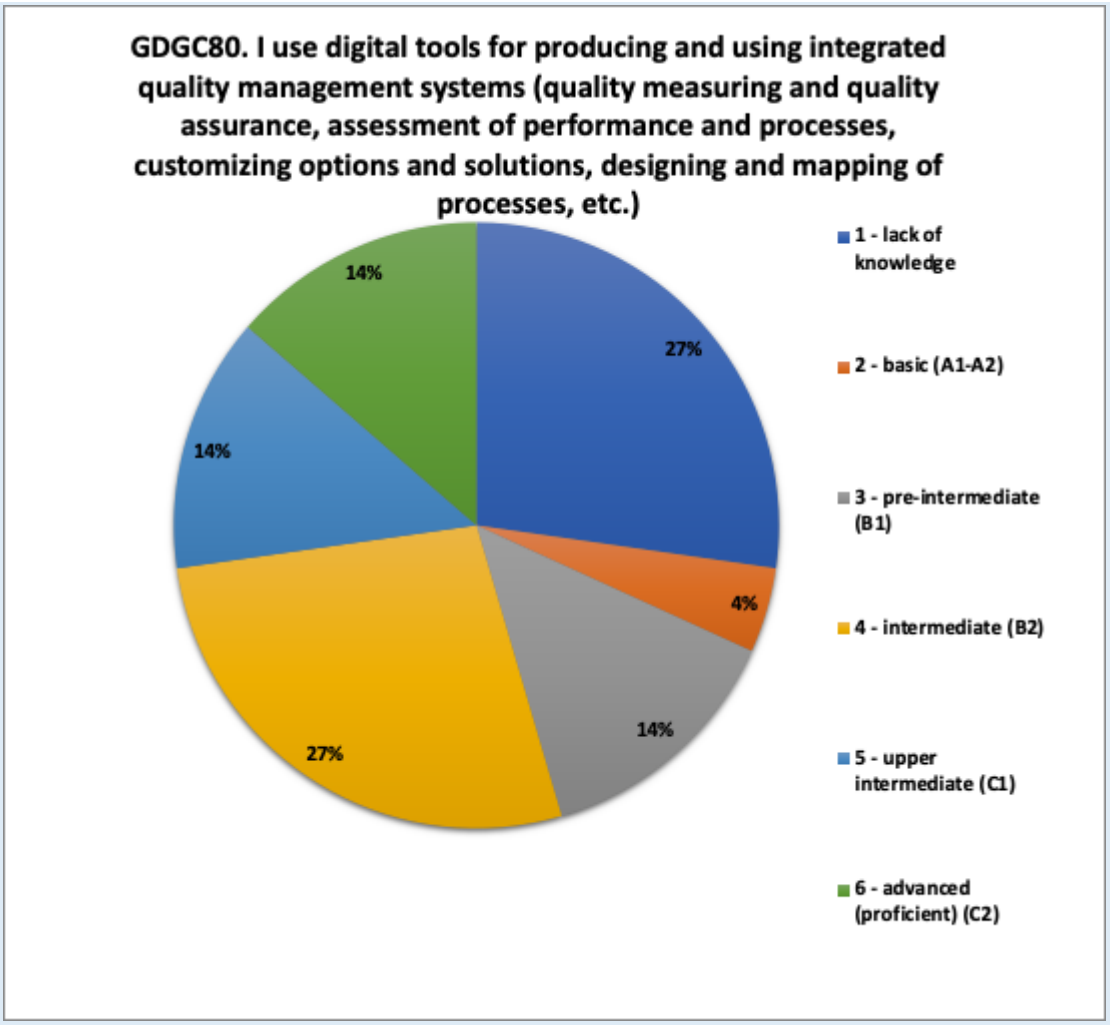

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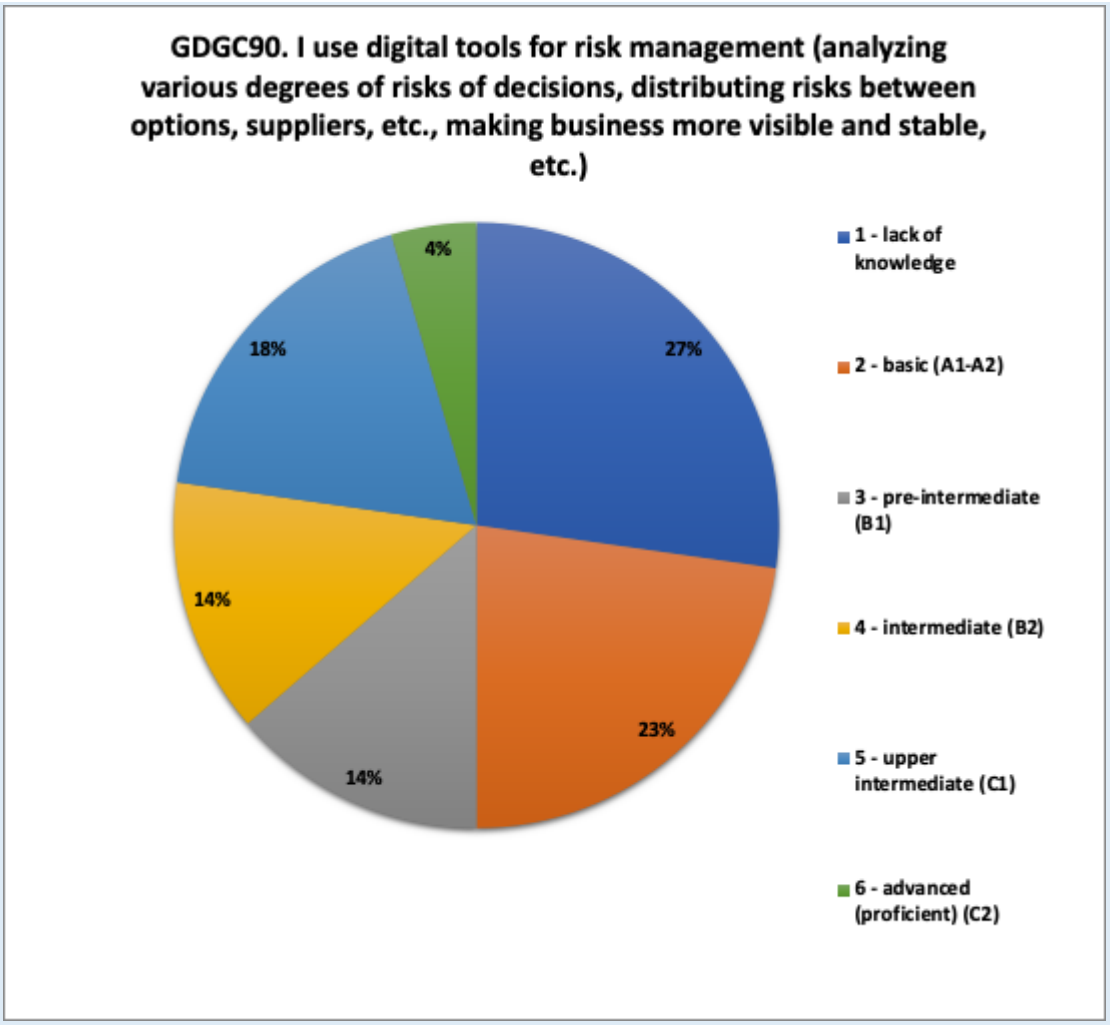

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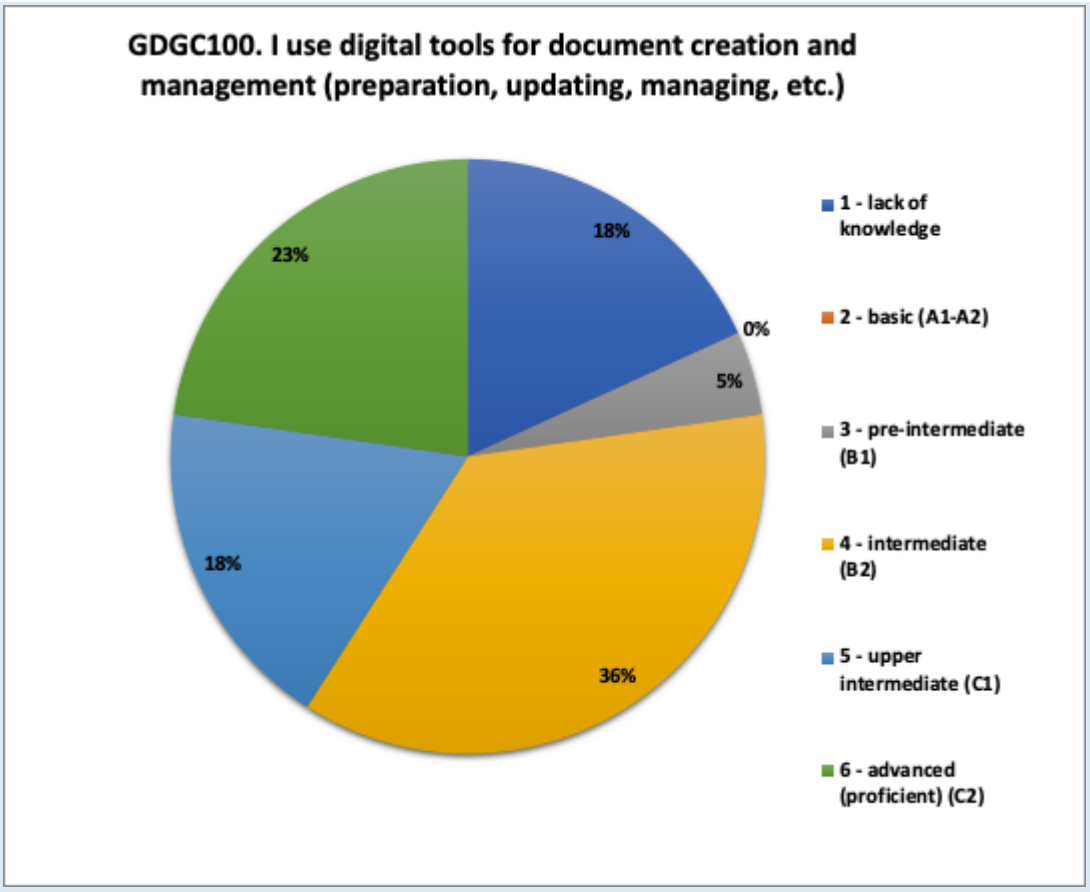

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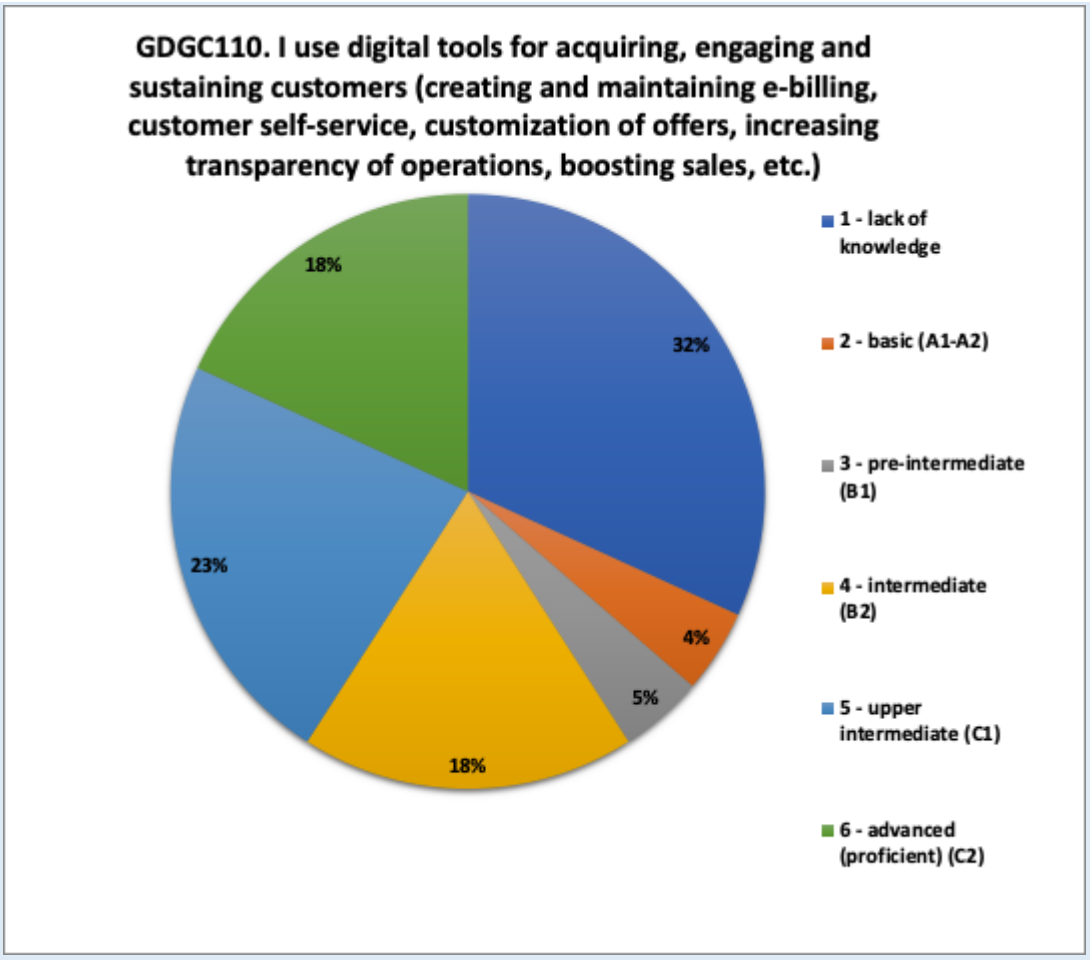

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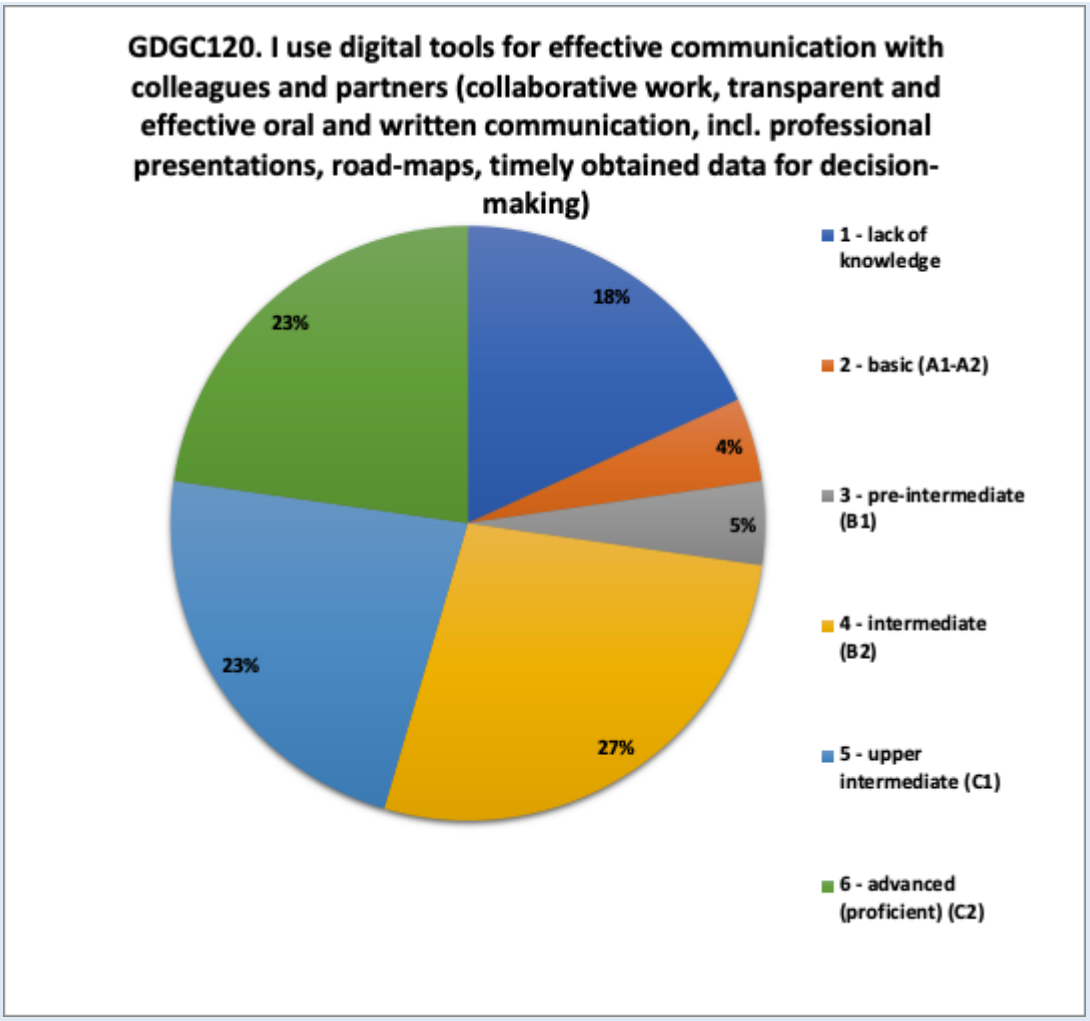
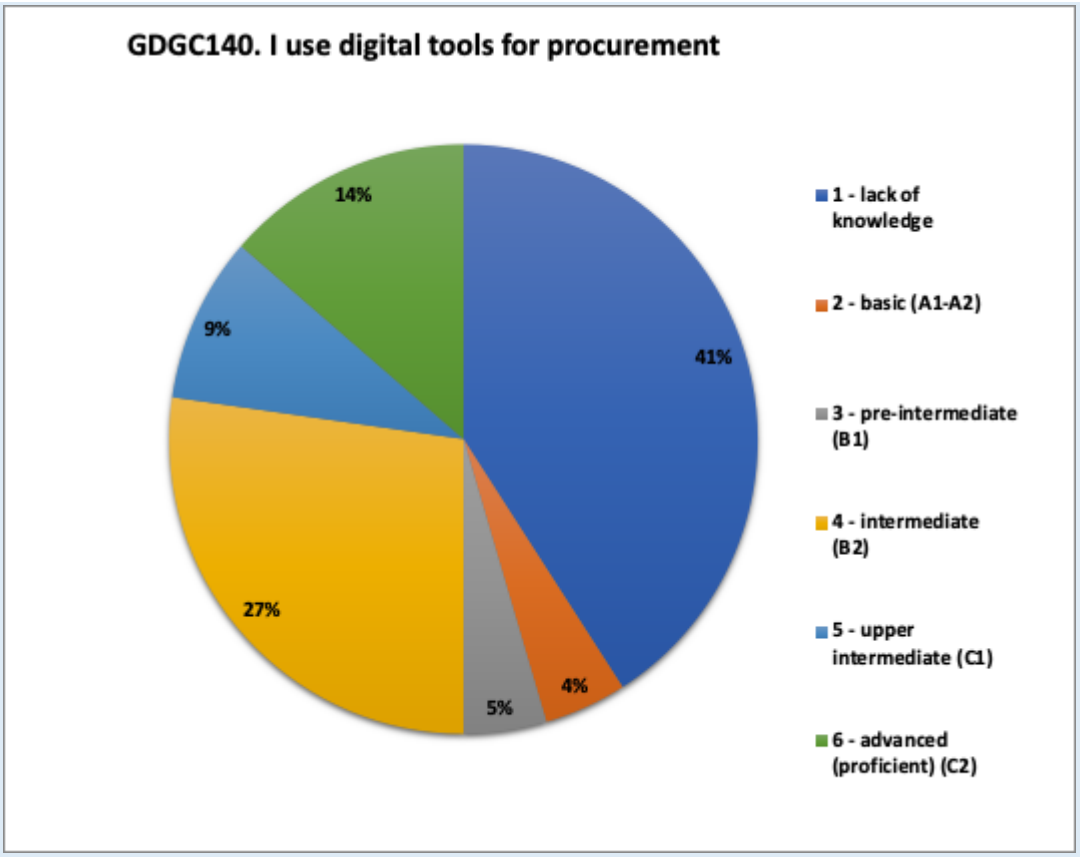

GDGC120. I use digital tools for effective communication with colleagues and partners (collaborative work, transparent and effective oral and written communication, incl. professional presentations, road-maps, timely obtained data for decision-making)
18%
4%
5%
27%
23%
23%
1 - lack of knowledge
2 - basic (A1-A2)
3 - pre-intermediate (B1)
4 - intermediate (B2)
5 - upper intermediate (C1)
6 - advanced (proficient) (C2)



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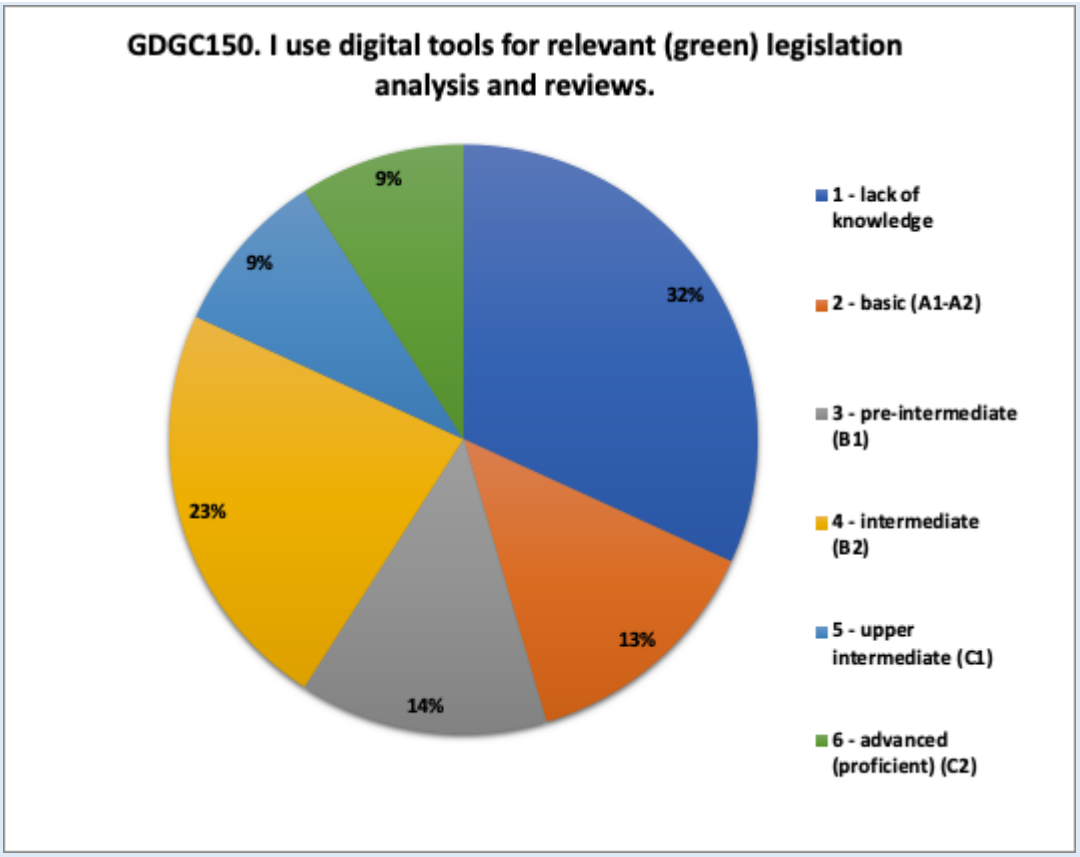

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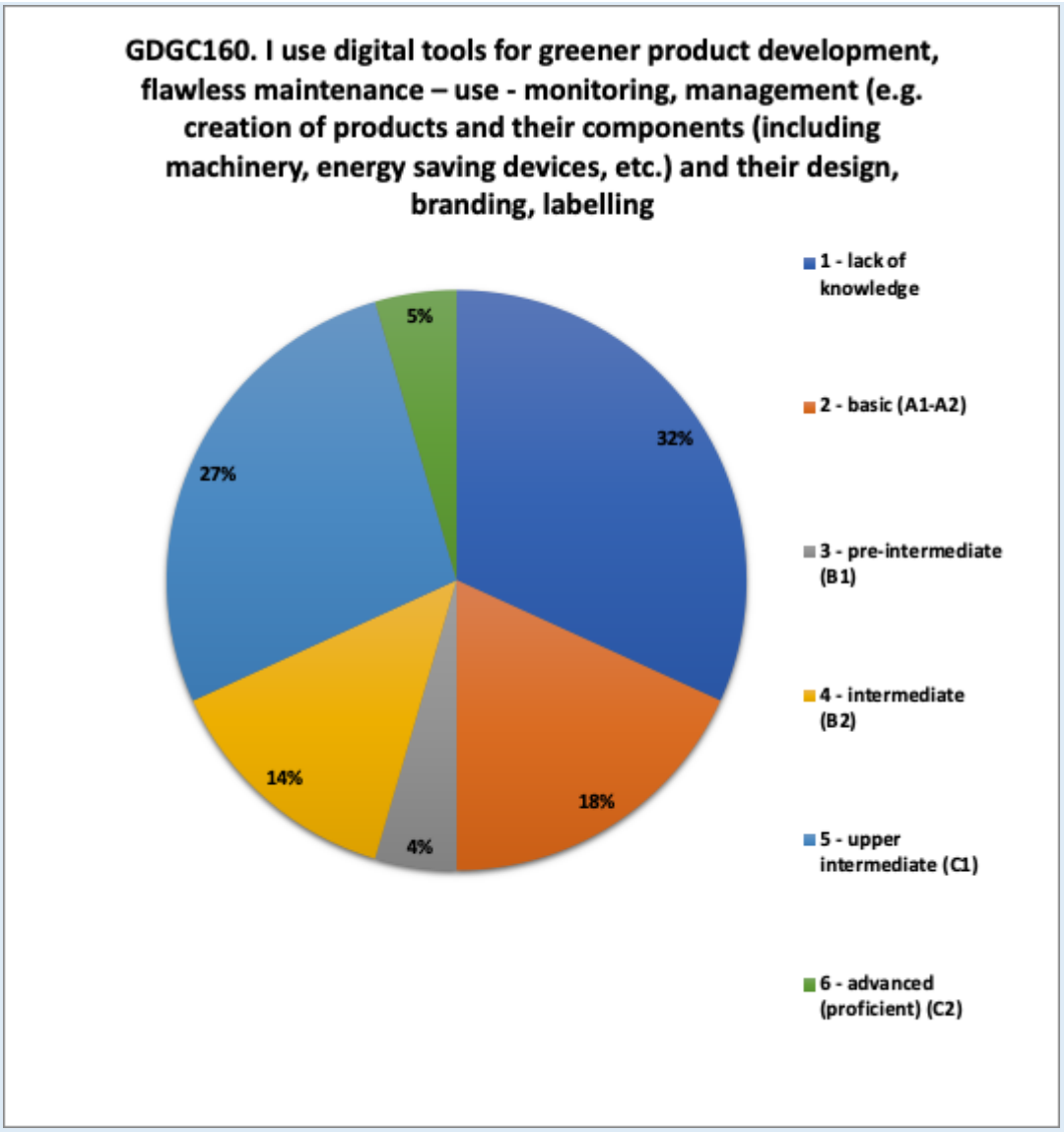
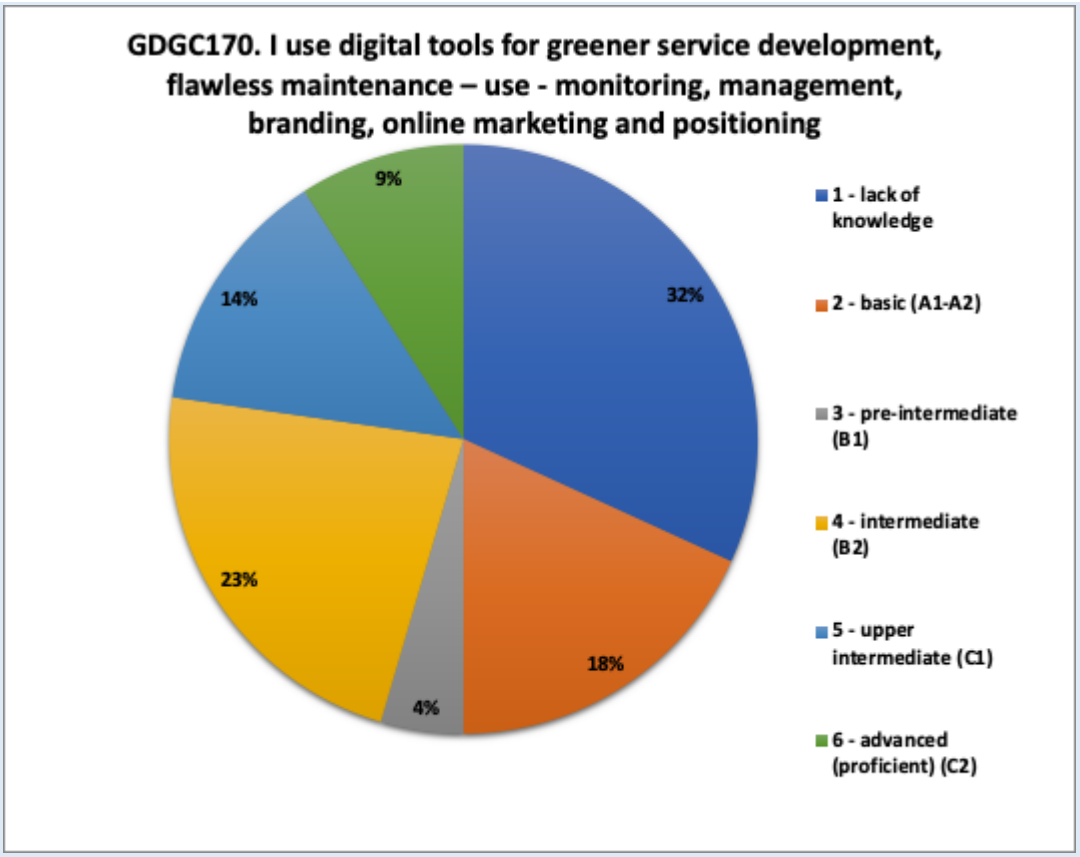

GDGC160. I use digital tools for greener product development, flawless maintenance – use - monitoring, management (e.g. creation of products and their components (including machinery, energy saving devices, etc.) and their design, branding, labelling
1 - lack of knowledge
2 - basic (A1-A2)
3 - pre-intermediate (B1)
4 - intermediate (B2)
5 - upper intermediate (C1)
6 - advanced (proficient) (C2)
32%
18%
4%
14%
27%
5%



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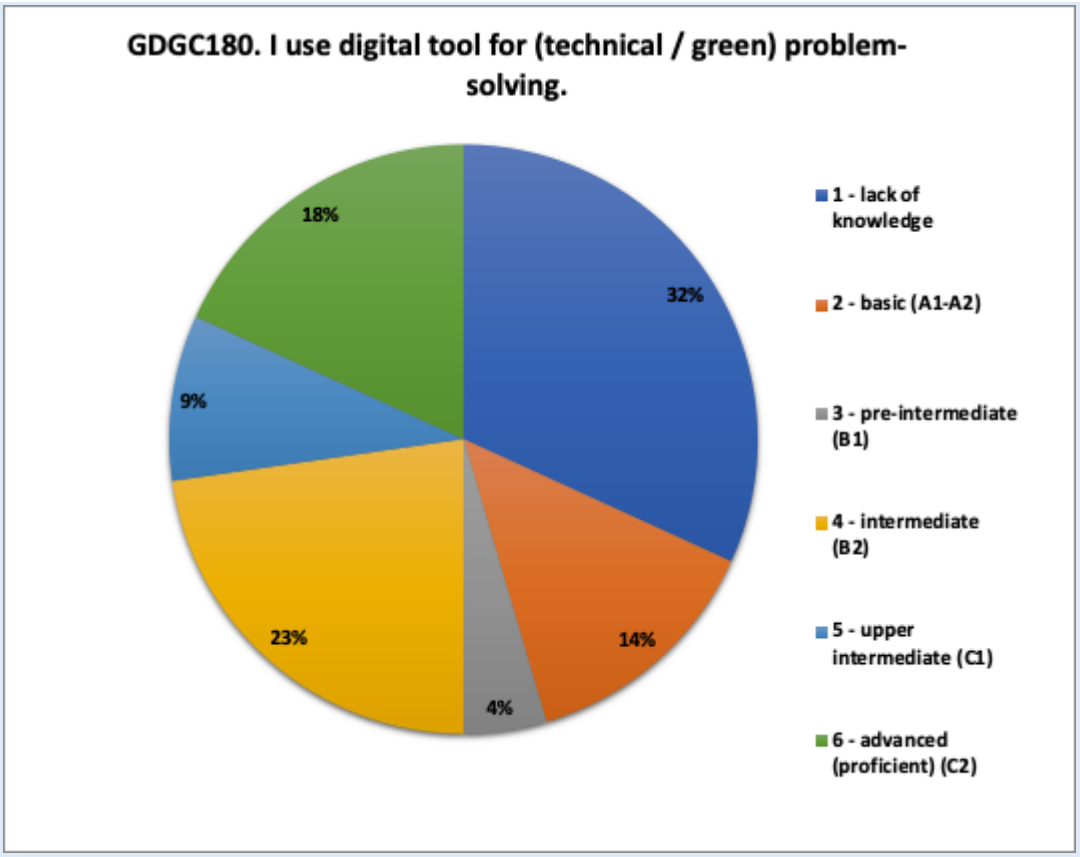

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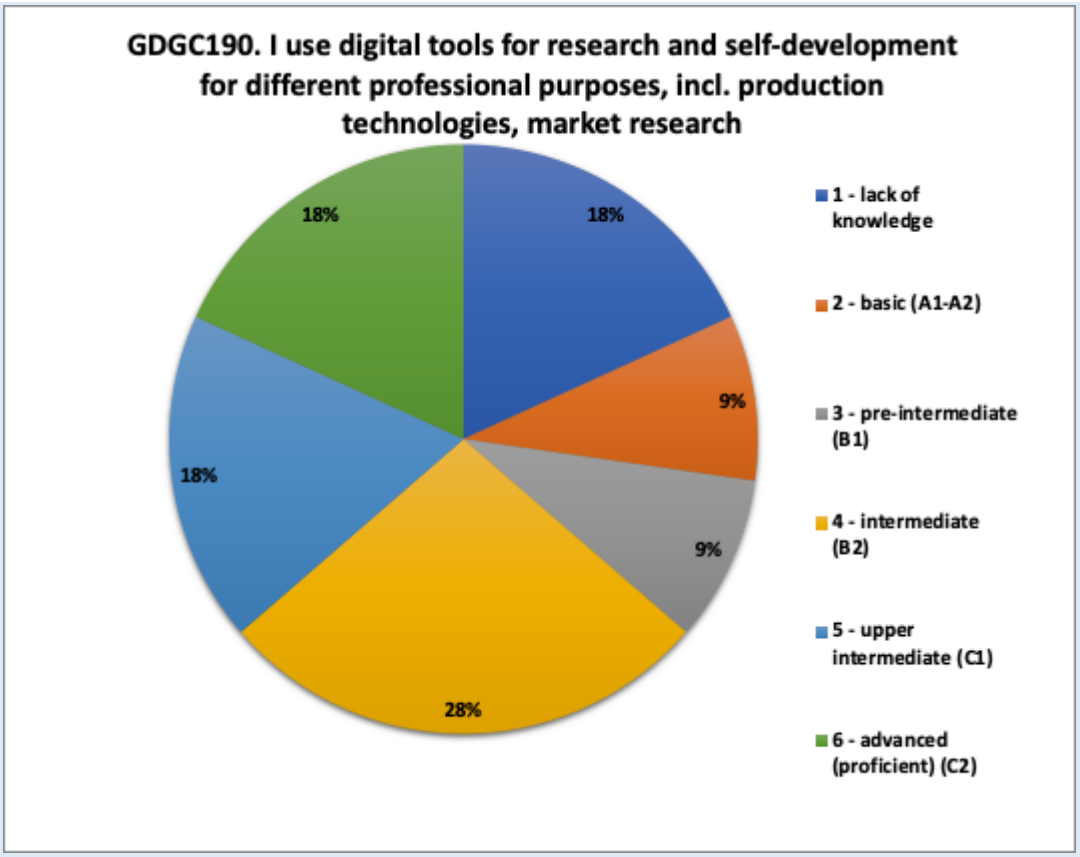
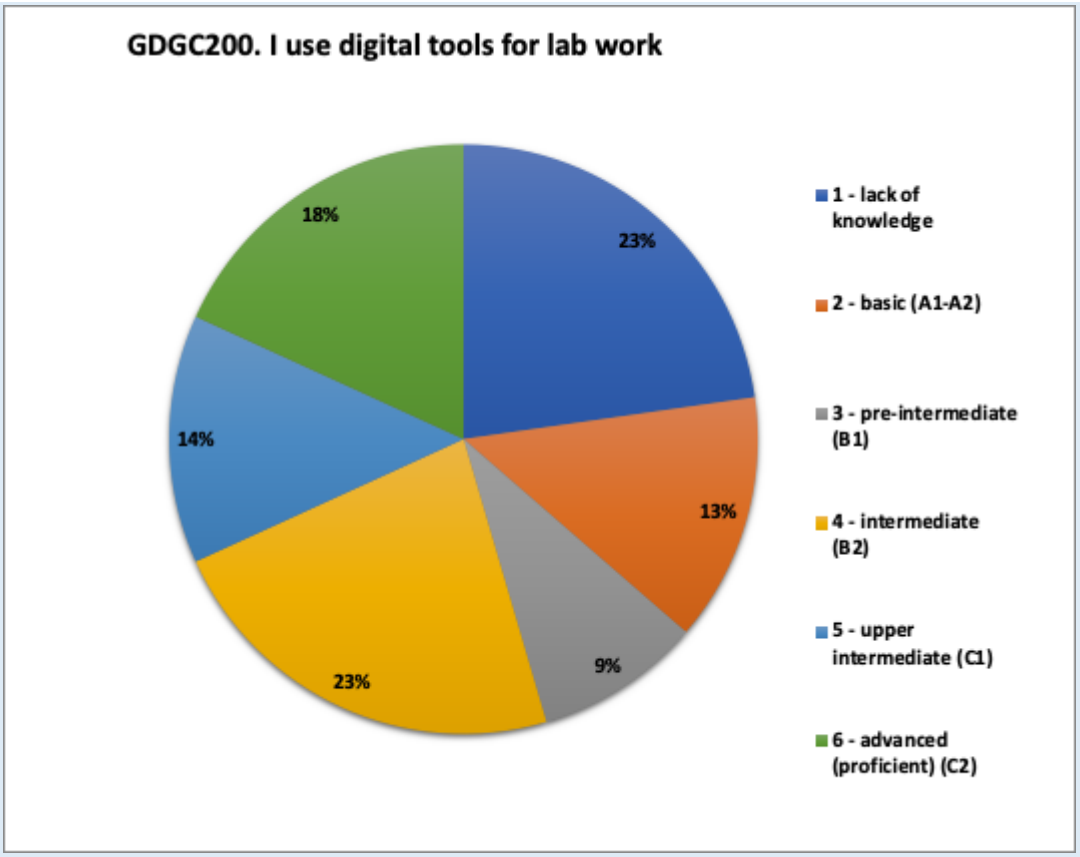
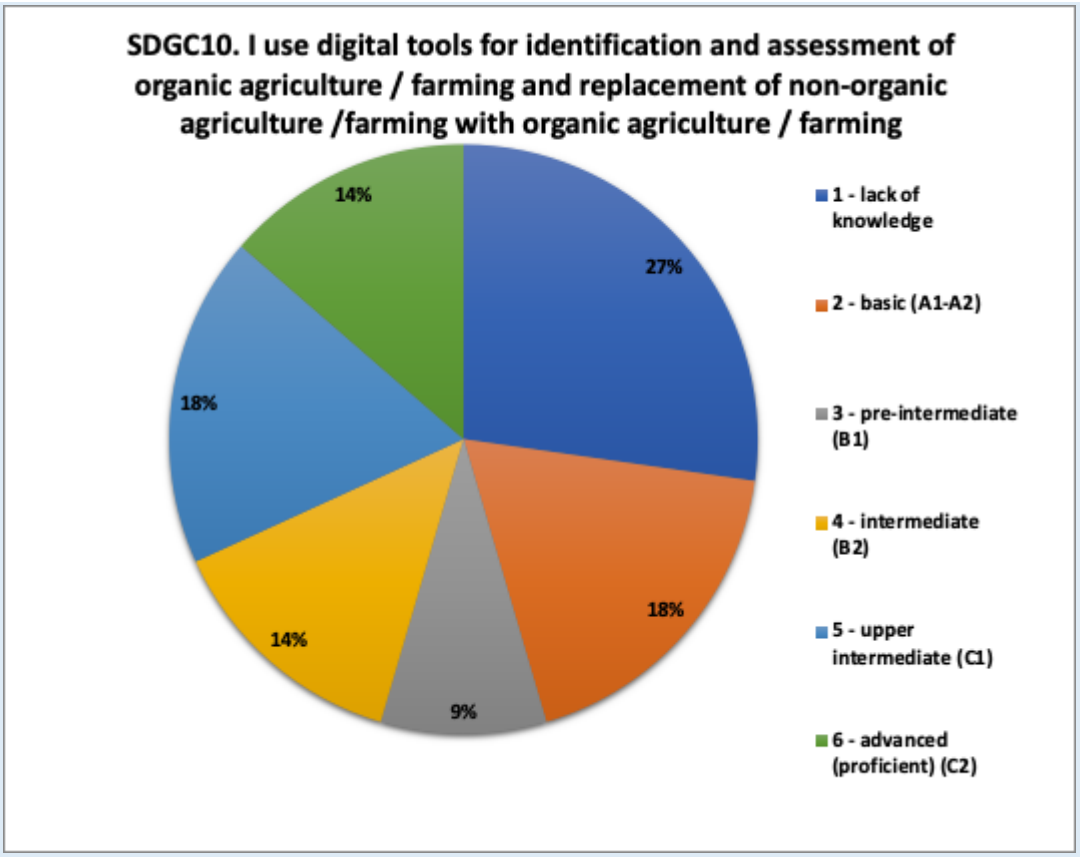

GDGC190. I use digital tools for research and self-development for different professional purposes, incl. production technologies, market research
18%
9%
9%
28%
18%
18%
1 - lack of knowledge
2 - basic (A1-A2)
3 - pre-intermediate (B1)
4 - intermediate (B2)
5 - upper intermediate (C1)
6 - advanced (proficient) (C2)


GDGC200. I use digital tools for lab work
23%
13%
9%
23%
14%
18%
1 - lack of knowledge
2 - basic (A1-A2)
3 - pre-intermediate (B1)
4 - intermediate (B2)
5 - upper intermediate (C1)
6 - advanced (proficient) (C2)



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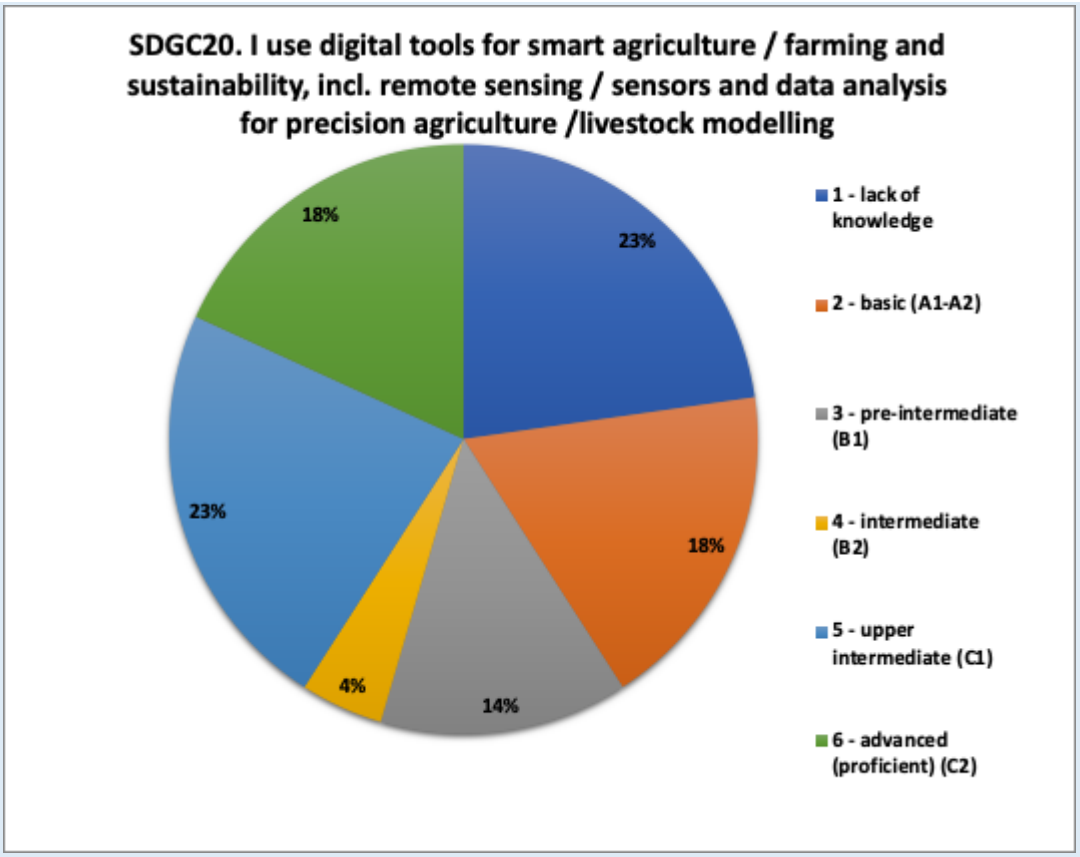

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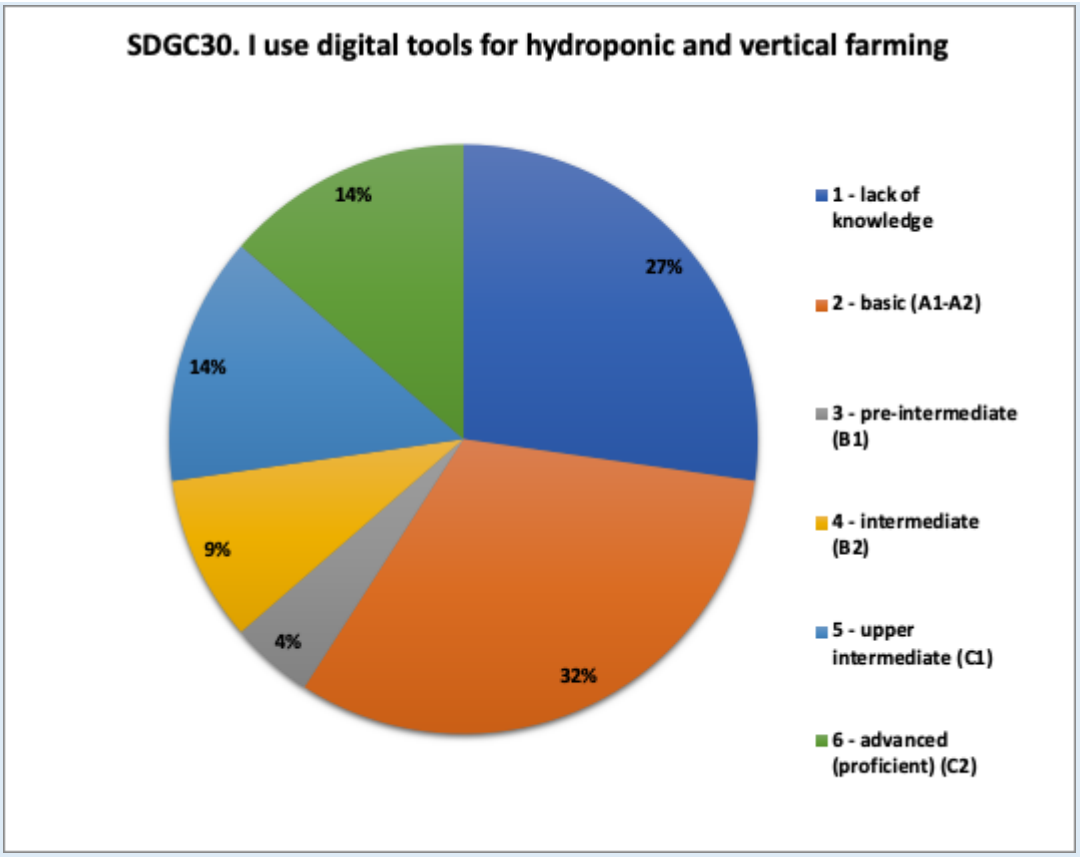

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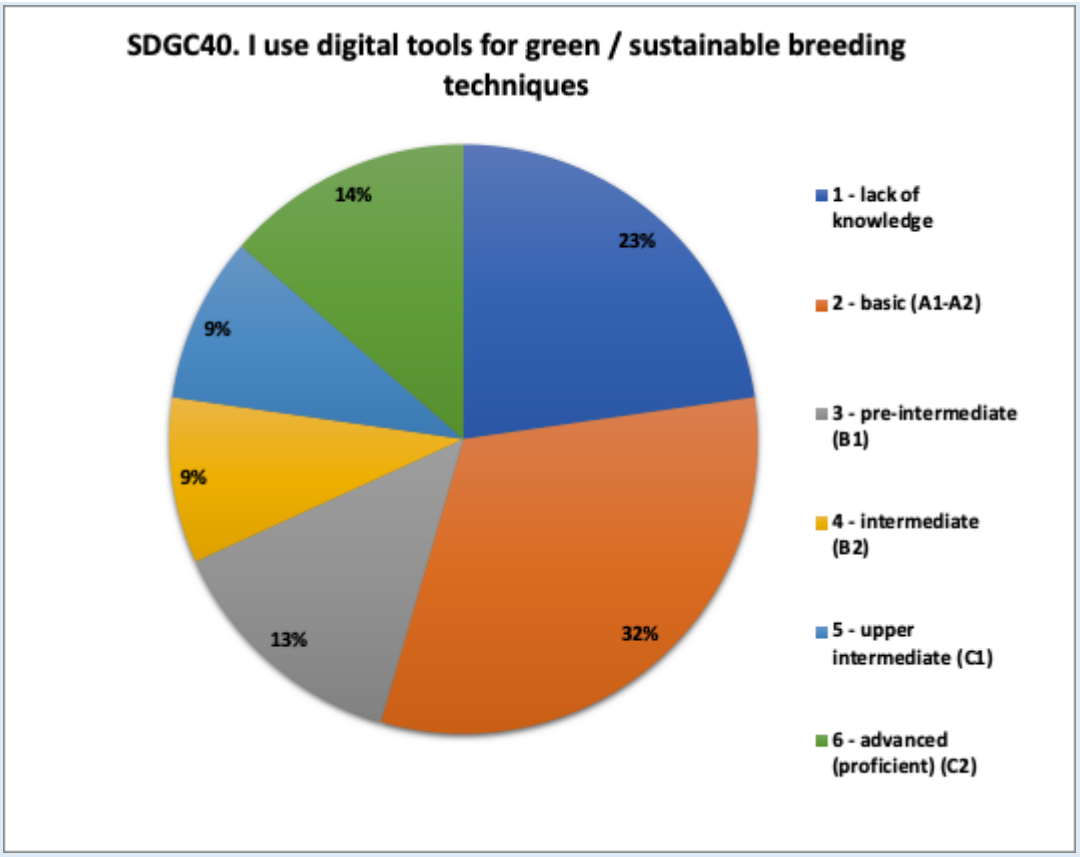

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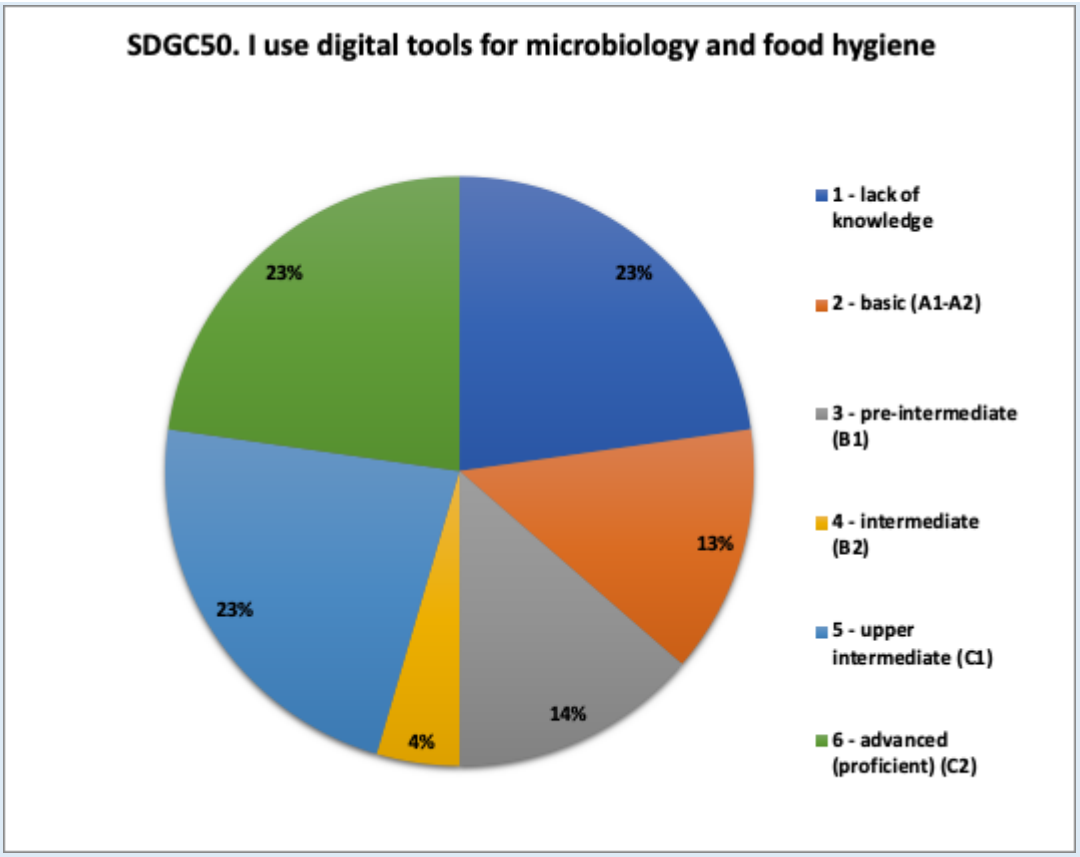
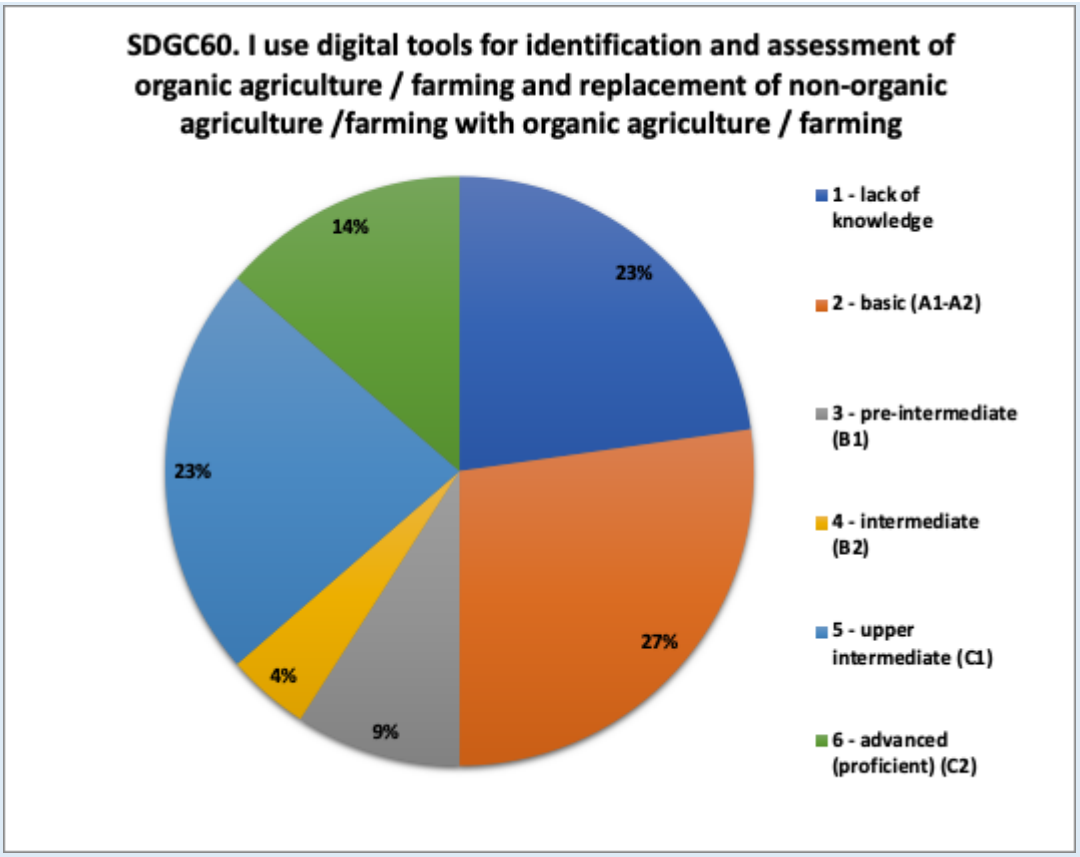

SDGC50. I use digital tools for microbiology and food hygiene
23%
13%
14%
4%
23%
23%
1 - lack of knowledge
2 - basic (A1-A2)
3 - pre-intermediate (B1)
4 - intermediate (B2)
5 - upper intermediate (C1)
6 - advanced (proficient) (C2)



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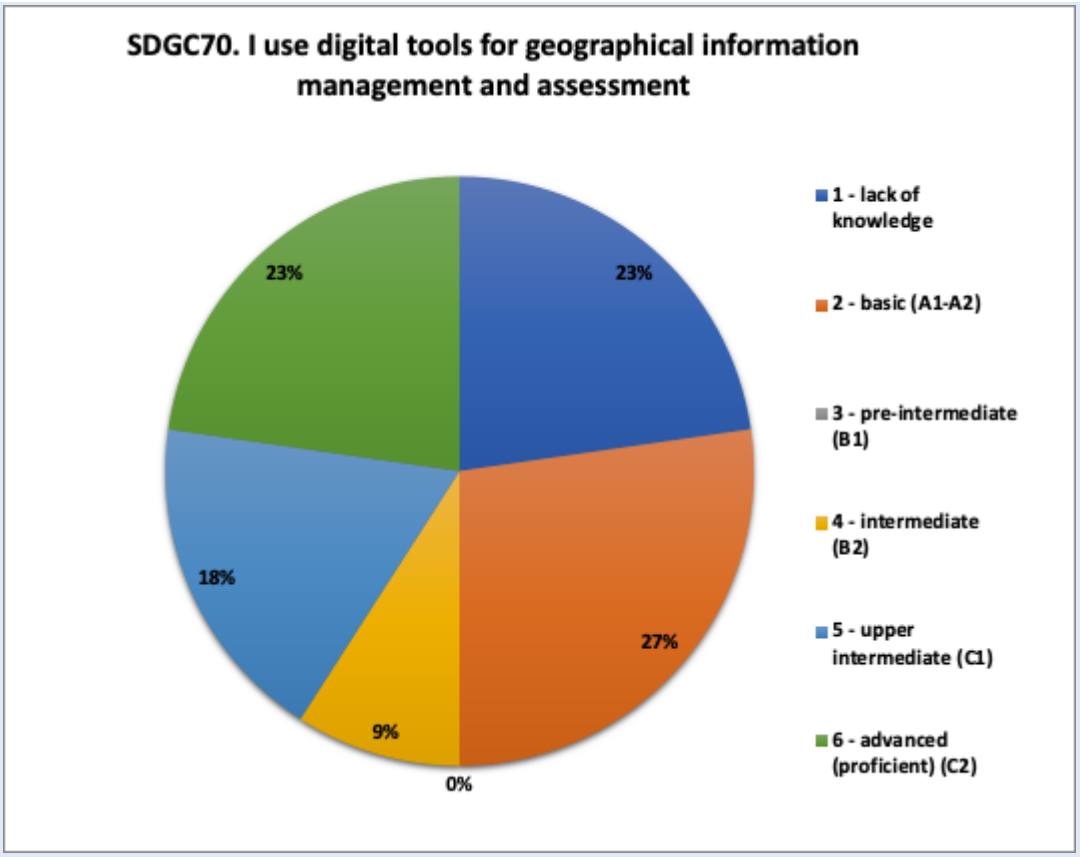

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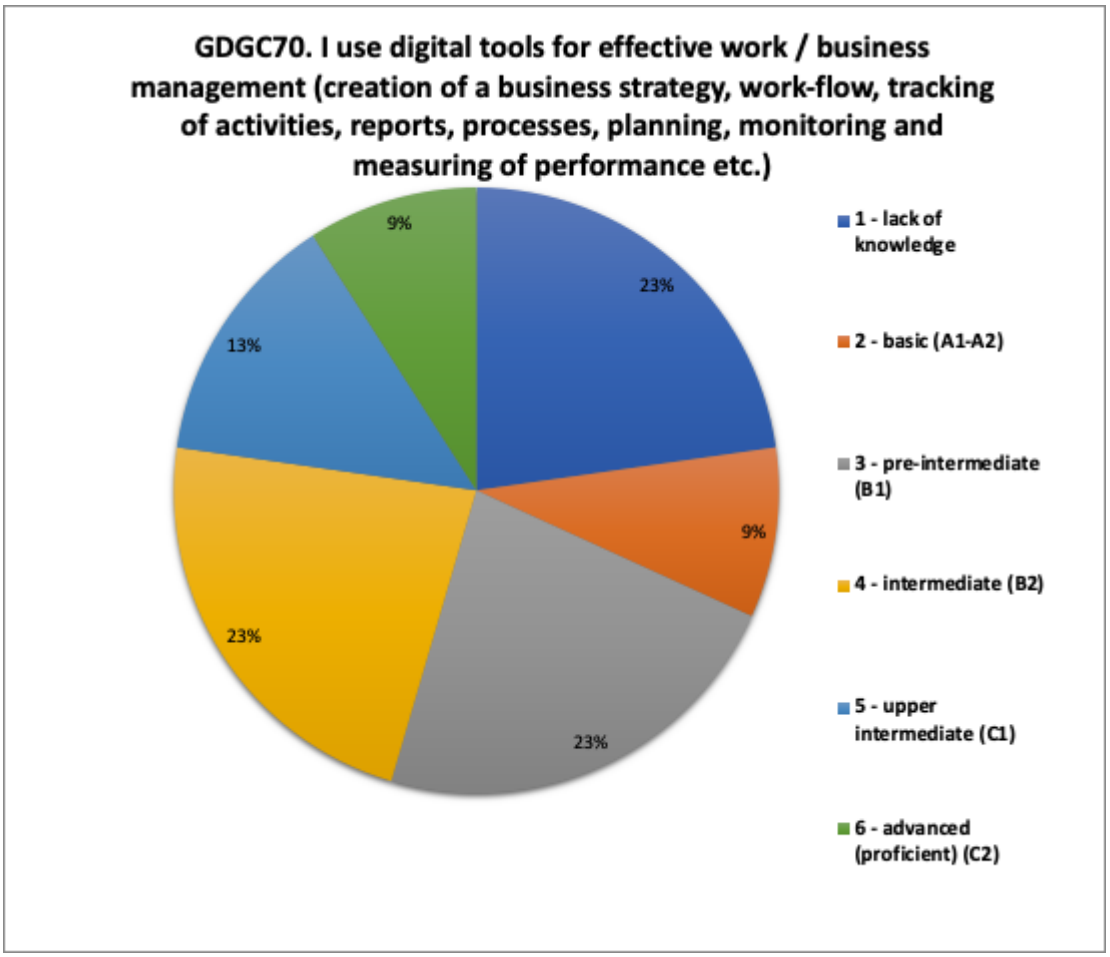
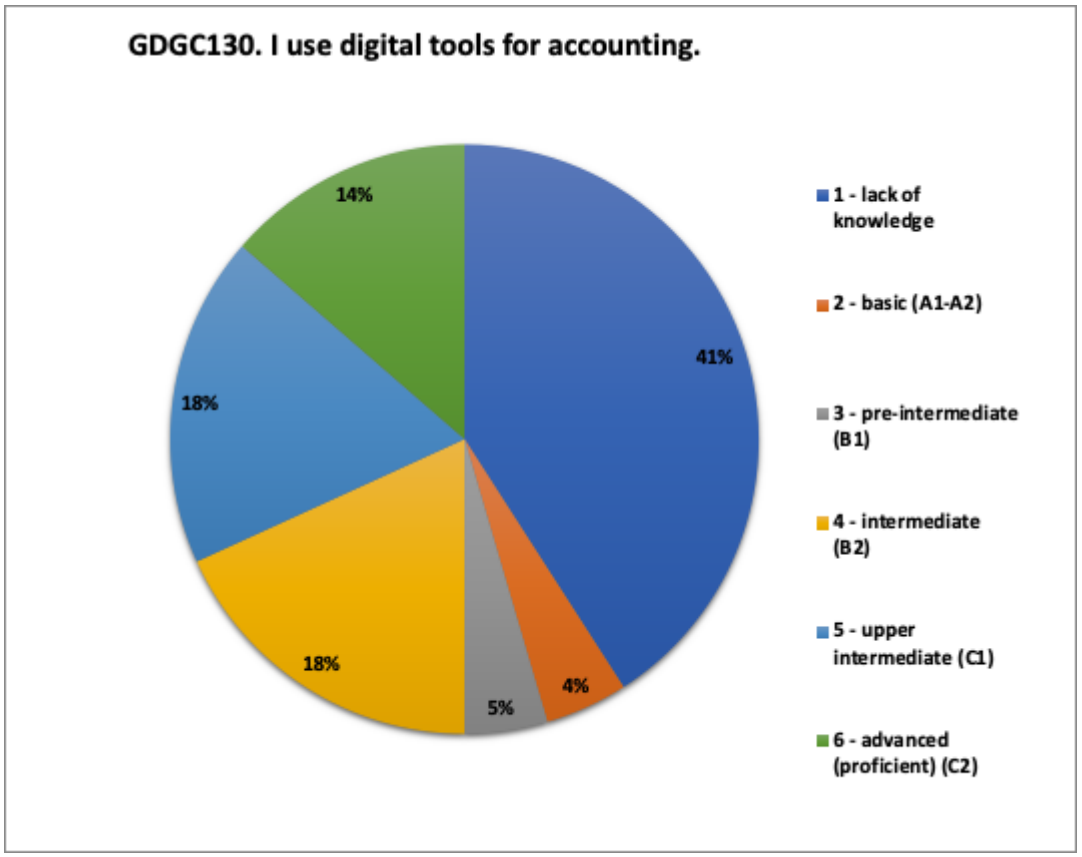

GDGC70. I use digital tools for effective work / business management (creation of a business strategy, work-flow, tracking of activities, reports, processes, planning, monitoring and measuring of performance etc.)
23%
9%
23%
23%
13%
9%
1 - lack of knowledge
2 - basic (A1-A2)
3 - pre-intermediate (B1)
4 - intermediate (B2)
5 - upper intermediate (C1)
6 - advanced (proficient) (C2)


GDGC130. I use digital tools for accounting.
14%
41%
18%
18%
5%
4%
1 - lack of knowledge
2 - basic (A1-A2)
3 - pre-intermediate (B1)
4 - intermediate (B2)
5 - upper intermediate (C1)
6 - advanced (proficient) (C2)