



ARBORTECH



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Arboriculture as a fundamental technique
for managing urban green spaces

Project Result 1

Summary Report on the state of vocational education and training for arborists



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A table of contents:

1. GENERAL INFORMATION	1
2. REQUIREMENT FOR WORKERS FROM THE ARBORICULTURAL FIELD IN THE LABOUR MARKET	2
3. POSSIBILITIES FOR EDUCATION AND TRAINING IN ARBORICULTURE	4
4. ARBORICULTURAL KNOWLEDGE, SKILLS AND COMPETENCES	5
4.1 Tree biology	5
4.2 Tree identification and selection	5
4.3 Soil science	5
4.4 Water management	6
4.5 Tree nutrition and fertilisation	6
4.6 Tree installation and establishment	7
4.7 Tree pruning	7
4.8 Tree protection on the construction site	8
4.9 Diagnosis of plant diseases and pests	8
4.10 Plant health care/risk assessment and management	9
4.11 Safe work practices and emergency response	10
4.12 Tree climbing, aerial rescue	10
4.13 Use of mobile elevating work platforms	11
4.14 Rigging and dismantling	11
4.15 Work planning and organisation, regulations and legal issues	11
5. SOFT SKILLS	13
5.1 Professional communication	13
5.2 Teamwork	13
6. CONCLUSION	14

This document is produced as a comparison of the Slovenian, Croatian and Slovak national reports, which were prepared as R1 in the framework of the Erasmus+ project ArborTech. We explored educational needs in the field of arboriculture. Each national report is based on a national analysis of employers' and employees' questionnaires and a review of arboricultural learning outcomes (knowledge, skills and competences), included in formal and non-formal curricula of existing educational programs.

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1. GENERAL INFORMATION

The Arbortech project aims to identify professional competences and develop new content in the field of tree care in urban environments. We were particularly interested in the competences required for arborists. A questionnaire for employers and employees was developed to identify the educational needs of people currently performing this type of work or who would like to requalify.

A total of 23 employers from the public, public-private and private sectors responded to the employer questionnaire - 9 from Slovenia, 3 from Croatia and 11 from Slovakia. The 39 employees filled out the questionnaire - 21 from Slovenia, 10 from Croatia and 8 from Slovakia. It should be noted that the project has been disseminated in this way, which is relevant for later pilot testing of the project results.

The second part of the national report consists of a review of arboricultural learning outcomes, which were included in already existing formal and non-formal educational programs. In Slovenia, we focused on the VET modules of Ornamental plant production, Arboriculture and vine cultivation, Green space management and Built components of green areas in the 3-year program in the field of horticulture, corresponding to EQF level 4 and 180 ECTS. Croatian partners emphasized learning outcomes in the module Dendrological types for arranging in the 3-year educational programme for Florist, corresponding to EQF level 3. Additionally, they reviewed a module Botany in the 4-year educational programme for Agricultural technician, corresponding to EQF level 4.

Non-formal courses, which include arboricultural learning outcomes and were exposed by partners, are Slovenian 50-hour Arboricultural course, Croatian Arborist course and Slovak courses, titled Biological properties of trees, Operational safety of trees in residences, Protection of trees during construction activities. Each of them lasts 10 hours.

2. REQUIREMENT FOR WORKERS FROM THE ARBORICULTURAL FIELD IN THE LABOUR MARKET

In all partner countries, there is a strong need for employees with arboricultural competences, which shows the high potential of the 'Arboriculture for Gardeners' training which will be developed in the project and to which the project deliverables R3 - R5 are linked.

In Slovenia and Croatia, employers mostly or completely use their employees (SI - 67%, Cro - 100 %) rather than higher outside contractors. The contrary is true for Slovakia, where 72.2% of companies prefer to outsource this type of service.

In Slovenia, 67% of employers in our survey need one or more new employees. The need is even higher in Croatia and Slovakia, where almost all companies express the need for at least two employees (Croatia – 100%, Slovakia – 90%).

Only 22 – 45% of companies look for experienced workers with international certificates and higher salary demands. Indeed, 54 – 67% of employers express the need for employees with completed secondary school.

In Croatia, all of the companies have previously employed or would consider employing interns. The percentage is slightly lower in Slovakia and Slovenia, where 67% and 56% of companies are willing to hire interns. Those companies, who already do, develop their knowledge and skills through mentorship, external courses and conferences or internal workshops and training.

Employers are mostly willing or willing to invest in employees' further professional development (Cro - 67%, SK – 82% and SI – 89%). In Slovakia, employers are willing to pay for one course, on average, from 100 to 500 EUR. In Slovenia and Croatia, the maximum amount for a course for employees would be up to 3000 EUR per person, but in Slovenia the reported amount for employees with the completed secondary school would be up to 1000 EUR.

A broad assortment of knowledge and skills of employees is important in all partners' countries because they often work as horticulturists (SI - 56% of companies, 67% - Cro and 36% - SK) and perform other work at height (SI and Cro - 33% of companies, SK – 9,1%) as well. Employers usually organize work in line with employees' knowledge, skills and experiences to satisfy customer needs and specific terrain requirements. The 'Arboriculture for Gardeners' training, which we will develop in this project, could serve to provide arboricultural knowledge and skills for horticulturalists thus expanding their area of expertise and usefulness to employers.

Despite the increased demand for arboricultural services, 33% of Slovenian and Croatian and 54% of Slovak employers would not employ persons with mild disabilities as tree workers. In 56% of Slovenian and 33% of Croatian companies, they would consider employment of disabled persons if their impairment didn't affect their performance. Very low percentages of employers would adapt their working positions (in SK – 27%). By developing Guidelines for employers, we – project partners would like them to consider employing persons with mild disabilities for arboricultural work.

However, employers in Slovakia would be willing to employ people with mild disabilities in other job-positions, as revealed in the interviews with employers. As an example, they pointed out an arborist adviser who would coordinate the practical work of arborists in the field, at height ...

3. POSSIBILITIES FOR EDUCATION AND TRAINING IN ARBORICULTURE

National vocational qualifications Forest thinner ((89% companies) and Tree caretaker at height (56%), which are validated as EOK4, are well known among employers in Slovenia. The percentage is lower among Croatian employers (33%).

In contrast to Croatian employers, Slovenian and Slovak employers are very familiar with international non-formal titles. The most popular are: ISA Tree Worker Climber Specialist (TW CS) (SI - 89%, SK – 72%), EAC European Tree Worker (ETW) (SI – 78%, SK – 72%) and ISA Certified Arborist (CA) (SI – 78%, 81%). Indeed, they also exposed ISA CA Municipal Specialist (CA MS) (SI – 78%), EAC European Tree Technician (ETT) (SI – 67%, SK - 54.5%) and Certified Tree Inspector FLL Zertifizierter Baumkontrolleur (SI – 67%, SK - 45.5%). Employers recognize these non-formal titles as proof of expertise. The Arbortech curriculum will strive to become internationally recognized and also internationally transferable with a defined EQF level and the possibility of validation with a certain number of ECTS points.

They are equally popular with both groups. Employers rely mostly on webinars, internet and YouTube content – 89%, even though only 45% of employees use it.

Lifelong learning is very important in the field of arboriculture, from the point of view of both employers and employees. Employers are familiar with arboriculture society lectures (SI - 78%, SK – 84%), tree climbing courses and competitions (78%), tree care courses (SI - 89%, SK – 84%) and certification courses (SI - 67%, SK – 84%).

Employers in the partner countries have different perceptions of the potential of the internet (and therefore of YouTube and webinars) as an educational channel for themselves and their employees. In Slovenia, it is used by 89% of employers and in Slovakia by 62%. In Croatia, online contents are as popular as info-days of different educational organisations.

However, we should bear in mind that the use of YouTube, webinars, and various online contents is not so popular among employees (SI - 45%, Cro - 20-30%). This is also in line with the Slovak employers' claim that the blended form of learning suits their needs.

4. ARBORICULTURAL KNOWLEDGE, SKILLS AND COMPETENCES

4.1 Tree biology

Competences:

- describe physiological processes in plant species,
- explain the function and process of photosynthesis,
- describe the structure of a root system, tree habitus, leaf, blossom and fruit and bark.

Current state in partners' countries

Employers indicated that knowledge of tree biology is quite important (SI - 78%, SK - 54%). The level of knowledge is adequate, with very few pointing out a knowledge gap (SI - 11%, SK - 9.1%), and the level of knowledge is also reflected in the sufficient self-assessments of employees (SI - 3.8, Cro - 3.3).

4.2 Tree identification and selection

Competences:

- identify ornamental species of trees and interpret their ornamental potential,
- implement arboricultural measures to maximise the tree's ornamental potential,
- identify (edible) fruit trees species in urban environment,
- differentiate between native, invasive alien species and also protected species,
- Identify the most common species of urban trees based on leaves, buds, bark, and other morphological features and named them in line with binary nomenclature,
- raise and train woody plants from seed/seedling to mature plant in nursery (nursery pruning, canopy shaping, transplanting, root system training, selection of suitable species for planting, solitary planting) ...

Current state in partners' countries

Employers have identified this arboricultural competence as one of the most useful in employees' daily work. In Slovenia and Croatia, persons with completed secondary school are usually able to identify 15 - 30 species and do not use binary nomenclature in Latin for species identification. Persons with upper secondary education level or even higher are able to recognize more than 30 species. 75% of Slovak employees recognize more than 30 species and name them in line with Latin and Slovak binary nomenclature.

Even so, the lack of this knowledge was not perceived as acute by employers and workers estimated themselves as quite competent in this area (self-evaluation SI and SK - 3.00, Cro – 3,7).

Nevertheless, this competence will be improved by the development of an arboricultural laboratory in the Arbortech project, where the learning process will be encouraged by multiple senses.

4.3 Soil science

Soil science (pedology) is important in several respects. The most important reason is to ensure that trees are adequately nourished, especially in urban centres. Due to the asphalt pavement, the limited space for root growth (installations, sewers, hardened substrate, etc.), the salinity of the soil and the consequent lack of oxygen, ensuring access to water and

minerals is crucial for the proper growth and development of the trees. In fact, trees in urban centres do not develop properly due to extreme abiotic factors (earlier foliage, later dormancy, etc.).

Competences:

- identify growth requirements of ornamental trees in urban environments regarding their location, water and nutrients (soil, water, light exposure, habitat),
- take samples for soil analysis,
- identify degraded soils that are not appropriate for planting urban trees,
- recognizes physiological disorders of urban trees,
- finds solutions for sufficient nutrition of urban trees in the field.

Current state in partners' countries

Only one third of employers indicate that their employees require knowledge and skills connected to soil science in their every-day work (SI - 33%, SK - 27%), while at the same time they are aware of a lack of knowledge in this area (SI - 44%, SK - 27%). On the other hand, employees label themselves as fairly competent (SI - 3.6, Cro - 3.3).

4.4 Water management

Water management in urban areas is becoming an increasingly important issue, driven by dry soil with gravel texture, global warming as a consequence of climate change, overheated urban climate ...

Competences:

- carry out irrigation of urban trees,
- select suitable tree species that are adapted to the changing climate,
- select appropriate locations for planting trees in urban areas,
- classify phytocoenological communities and transfer their principles to the design of urban groves,
- monitor new trends on the market and select new species and varieties that are able to adapt to climate change (exotic plants).

Current state in partners' countries

The employers' perception of water management competences in everyday work of an arborist varies between the partner countries (SI - 56%, SK - 27%). However, in all three partner countries, the employers did not point out a lack of knowledge and the self-assessment of the employees is extremely high (SI - 4.4, SK - 4.2).

4.5 Tree nutrition and fertilisation

Soils in urban areas are poorly nourished, of low quality and leached out. To maintain the normal growth and development of ornamental trees, it is sometimes necessary to properly fertilise the mature trees.

Competences:

- Identify physiological disorders and deficiencies of individual nutrients of woody plants,
- Differentiate between physiological disorders and diseases of woody plants,
- Indicate the role of individual soil nutrients for the growth and development of woody plants,
- Provide good plant-growing conditions (also appropriate fertilisation) and maintain the nutrient supply of the soil in the later years of the tree's life.

Current state in partners' countries

The employers' perception of tree nutrition and fertilisation competences in everyday work of an arborist varies between the partner countries (SI - 56%, SK - 27%). However, in all three partner countries, the employers did not point out a lack of knowledge (SI – 0%, SK – 9%). However, Slovenian employees rated the level of competences related to tree nutrition and fertilisation as sufficient (SI – 3,6), Croatian employees reported the second highest self-assessment of all competences (Cro – 4,1).

Slovenian experts comment that topics in the field of pedology are barely addressed in arboriculture and horticulture curricula, which could be attributed to the results of soil-related topics – soil science and tree nutrition.

4.6 Tree installation and establishment

The basis of an arborist's work is identifying different ornamental plants and their ornamental potential. In the past, many errors have been made with the installation of inappropriate trees in the urban environment (too large, allergenic, toxic, thorny, etc.) due to a lack of knowledge of dendrology.

Competences:

- select the appropriate plants (species, variety and cultivar) for the planting location, considering growth requirements, habitus, the life cycle (and their phases) of each species or variety, their characteristics at maturity, etc.,
- select species and varieties according to their habitus potential (columnar/elongate, weeping, spreading habitus),
- make a list of suitable trees for a particular site or plantation, considering the surrounding environment, growing requirements, human health, etc. (pay attention to possible allergies, leaf fall, excessive trunk diameter, shading, etc.).

Current state in partners' countries

Employers consider the competence of tree installation and establishment to be applicable in the regular everyday work of an arborist (SI - 78%, Cro - 63%). Both employers (lack of knowledge - SI - 11%, Cro - 0%) and employees consider themselves to be sufficiently competent in this domain (self-assessment - SI and Cro - 3.6). These results can be linked to the high level of knowledge and skills in the field of dendrology acquired during formal education.

4.7 Tree pruning

In this chapter, we address the care and maintenance of trees in their various life phases, connected to different types of pruning. An arborist uses the working tools in the pruning process. Pruning and trimming can encourage or restrict tree growth to maintain the natural

appearance of the canopy or make it more aesthetically pleasing to humans. In the past, professional mistakes have been frequently observed, as the pruning has been carried out mostly by unqualified workers.

Competences:

- choose the appropriate working tools for pruning,
- select the appropriate pruning techniques based on knowledge of the tree's biology, timing of pruning, life stage of the tree, tree species,
- master pruning techniques for young, mature and veteran trees,
- predict the physiological response to pruning,
- recognise mistakes or predict hazards arising from incorrect pruning (overgrowth, future risk situations).

Current state in partners' countries

Competences related to pruning are among the most useful in the daily work of an arborist (SI - 89%, SK - 72%). The opinion of employers and employees is that the level of these competences is sufficient or quite high (employees' self-assessment - SI - 4.2, Cro - 3.5), which is also confirmed by the results of the survey questions related to the familiarity with pruning practices.

4.8 Tree protection on the construction site

During the construction process, trees could be damaged. We can discuss trunk wounds, damages due to digging holes around trees, leaching of lime, etc.. The basis for mastering the above-mentioned skills originates from the knowledge of the tree's biology. However, for the implementation of these skills, an arborist needs to collaborate with other workers on construction site.

Competences:

- accurately and correctly measure the height and diameter of the tree and fill them in correctly in the proposed form,
- protect trees on the construction site,
- install tree protection before the start of the construction operation, and remove it after its completion.

Current state in partners' countries

Employers rate competences, related tree protection at the construction site as moderately applicable to applicable (SI - 56% - 78, SK - 63% - 72%) and they also point out minor skills gaps (SI - 11 - 33% of companies, SK - 9.1 - 27%), while employees' self-assessments are also sufficient (SI - 3,0 - 3.6, Cro - 3,0 - 3.8).

The average self-assessment of employees is above expectations, which means that they are aware of the importance of tree protection during the interventions on the construction site. In reality, examples of bad practices can often be observed in the field.

4.9 Diagnosis of plant diseases and pests

The introduction of alien ornamental species into natural and urban ecosystems could reduce the level of biodiversity by affecting native tree species and risking the spread of new diseases and pests. The process will be facilitated in the future by climate change.

On the other hand, alien tree species will not necessarily adapt to our climatic conditions. They are often more susceptible to diseases than native species. Of course, the origin of the tree species itself is also important in the selection process.

Competences:

- Identify diseases and pests of ornamental trees and follow new findings in forest phytopathology,
- Analyse the phases of infections and the extent of damage to the tree (invasion, recognition of symptoms, spreading)
- Find possibilities to address diseases and pests' issues,
- Identifies native tree species and their importance to ecosystem services and human welfare,
- Predict the impact of climate change on the appearance of invasive plant species and take the necessary preventive measures.

Current state in partners' countries

Employers rate competences related to diseases and pest diagnostics (SI - 67%; SK - 54%;), while they also expose employees' insufficient knowledge (SI - 33% of companies, Cro - 27%). These results are confirmed also by lower self-assessments of employees (SI - 2.6, Cro - 3.7). They are more confident in their knowledge and implementation of biodiversity conservation measures (self-assessment - SI - 4.0, Cro - 3,7).

These findings could be interpreted as a consequence of the lower share of phyto-pathological content in formal education programmes. The Arbortech curriculum could be an opportunity to strengthen competences, correlated to identifying and addressing diseases and pest issues.

4.10 Plant health care/risk assessment and management

One of the main tasks of arborists is proper tree health care, which is required for the normal development of the tree. It involves providing suitable growing conditions when the tree is planted, frequent monitoring and the use of preventive measures in subsequent years to ensure the viability of the tree. In combination with the presence of diseases and pests, physiological disorders may also be detected, but sometimes they are difficult to identify.

Older trees in urban areas could be hazardous to citizens. To address this issue, it is necessary to inspect the trees prior to any intervention, to assess their vitality and potential for regeneration after the intervention.

Competences:

- take care for the health of the trees and their vitality in subsequent years after planting,
- check the stability, resilience and longevity of the trees,
- select appropriate tree species to form groves in urban environment,
- select appropriate species and varieties of trees according to their characteristics in youth and older life phases,
- select non-allergenic, non-toxic and other non-hazardous tree species for urban environments,
- select species that are able to adapt to or tolerate the changing climatic conditions in urban areas.

Current state in partners' countries

Employers rate the applicability of competences related to plant health care as moderate (SI - 67%, SK - 45%), while the competences of risk assessment and management are among the most important and relevant for arborists (SI - 89%, SK - 82%).

Employers also point out the employees' slightly insufficient knowledge of plant health care (SI - 33% of companies, Cro - 18%). These results are confirmed by the lower self-assessments of employees (SI - 3.0, Cro - 3.8). In contrast, self-assessments of risk identification and assessment are considerably higher (SI - 4.0 - 4.2; Cro - 3.4 - 3.7)

4.11 Safe work practices and emergency response

Tree work and work sites could pose a risk for workers and near-by passengers. Protection of the worker and the work site (labelled by safety signs, warning lights, restriction of access to the work site by a signal rope, etc.) is therefore essential.

Competences:

- predict dangerous situations at the worksite and intervene appropriately,
- comply with health and safety work legislation; use the appropriate protective equipment and properly secure and label the work site,
- justify the reasons for the protection the work site for near-by passengers,
- choose the appropriate rescue strategy for the specific situation in the case of an occupational accident,
- call for medical assistance in the case of an occupational accident and give first aid treatment.

Current state in partners' countries

Employers consider safety-related competences to be extremely important and among the most applicable in the every-day work process of an arborist (SI - 89%, SK - 72%), but at the same time they expressed a slight lack of employees' knowledge (SI - 22%, SK - 9%). In Croatia, employees perceive to be the least competent in safe work practices out of all the skills mentioned (self-assessment – Cro - 2.8, SI – 3,8), but they are slightly more confident in the field of emergency response (SI – 4,0, Cro – 3,2).

4.12 Tree climbing, aerial rescue

Climbing a tree requires knowledge and skills in climbing techniques, the use of arborist ropes and knots, and working safely at height. In addition to climbing techniques, the nature of the work often involves the correct and safe use of a chainsaw at height. In the case of an occupational accident, the arborist must be able to climb to and safely lower an injured person, who is unable to descend without assistance.

Competences:

- climb a tree with the use of proper climbing techniques (and climbing ropes and knots) to work safely at height;
- know various cutting techniques and use a chainsaw when working at height;
- secure the area of the accident, administer first aid

Current state in partners' countries

Employers rate the importance of the use of competences related to tree climbing and use of climbing ropes and aerial rescue from moderately important to important (SI - 56%, Cro - 89%), which is also in line with employees' self-assessment of being fairly competent (SI - 3.2, Cro - 3.5)

When it comes to climbing techniques, we noticed in the survey that most of the participants don't have proper knowledge and equipment to work at height. On the other hand, we see a group of employees (arborists) who specialise in this area. They are familiar with the technique, have the appropriate equipment and tools for working at height, the appropriate training and the necessary certificates, which enable them to work well and professionally.

4.13 Use of mobile elevating work platforms

Mobile elevating work platforms are an important tool/device for tree care at height and are particularly commonly used in urban areas. For their operation it is necessary to have a special qualification.

Competences:

- use of mobile elevating work platform (and is aware that it requires a certificate for use),
- properly secure and label the work site at the beginning the work process in line with legislation.

Current state in partners' countries

Employers rate the competences related to use of mobile elevating platforms as quite applicable to very applicable (SI – 78%). In Slovakia, about 16% of employees use this device, and an even higher percentage are not trained to use it (SK - 45%).

The situation is quite similar in Slovenia, where only a certain group of employees, mainly from larger companies, can work on it. Quite understandable, as not all tree care companies have this device.

4.14 Rigging and dismantling

Rigging and dismantling is an advanced set of arborist techniques important for tree work, when regular techniques cannot be employed. With proper rigging techniques we are able to manoeuvre the cut piece of wood safely to the appointed drop site. Dismantling is used when the tree has such dimensions that it cannot be felled in the regular fashion.

Current state in partners' countries

Employers ranked these competences from fairly to very applicable in the daily work of an arborist (SI - 56%, SK - 90%), while also indicating a slight knowledge gap (SK - 18% of companies), which can also be addressed more broadly as part of the work finalisation.

4.15 Work planning and organisation, regulations and legal issues

Good organisation and planning are essential for the smooth running of the work. Availability of human resources, tools and equipment, time management, seasonal activities related to

arboricultural activities and work site-specific requirements are variables that influence the work process of an arborist.

Competences:

- follow the proposed system of work and the plan of arboricultural interventions on urban trees,
- make a time management plan,
- produce good work to a high standard, taking into account weather and other working conditions (availability of crew, equipment, devices and transport vehicles).
- comply with professional and occupational health and safety legislation in their work.

Current state in partners' countries

Employers reported competences related to work planning and organisation, regulation and legislation as moderately important for the day-to-day work of an arborist (SI - 56%, Cro - 63%), which is also confirmed by sufficient self-assessments (SI - 3.8, Cro - 3.2).

5. SOFT SKILLS

5.1 Professional communication

In Slovenia and Slovakia, it was noticed an inadequate level of professional communication with co-workers, customers and the public in half of participating companies (SI - 56%, SK – 45%). In contradiction to the situation in Slovenia and Slovakia, companies in Croatia considered the level of professional communication of workers to be sufficient.

Nevertheless, employees rated their level of professional communication as competent.

5.2 Teamwork

The ability to work in a team is important because employees usually work in tree crew groups, which usually consist of two members (SI -56% of companies) or even more (3 or more - Hr). In Slovakia, the importance of individual adaptability to the group was highlighted (36% of companies), as individual crew groups are combined together by employers according to need. On the other hand, among employers we also found self-employed entrepreneurs, who have to demonstrate a high degree of autonomy.

6. CONCLUSION

Personal characteristics such as responsibility, reliability, high motivation for work and affinity for nature present advantages in the employment process. The development of these values should also be part of the curriculum. Indeed, values promote the faster acquisition of knowledge, skills and competences, and encourage learners to pursue higher levels of educational goals.

To avoid a shortage of arborists in the future, it is essential to start the promotion of the profession at an early age by encouraging interest in trees and shrubs. Later on, the promotion should be built on presenting the advantages of the profession.

Lifelong learning through the presentation of new arboricultural insights and the upgrading of knowledge and skills in courses, training and webinars should be arranged with reimbursement of the costs of the educational fees for trainees, it could be also arranged the reimbursement of accommodation expenses.

Proposed actions for the promotion of the profession:

- establishment of an innovation day for arborists and arboricultural experts,
- establishment of informational centres where the general public of various age groups could also find answers to their curiosity.