



European  
Commission



Assessment of the potential contribution of mechatronics  
to economic development and diversification in

# Stara Zagora

START Sectoral Report

Energy

## EUROPEAN COMMISSION

Directorate-General for Energy

Directorate B – Just Transition, Consumers, Energy Security, Efficiency and Innovation

Unit B.1 - Consumers, Local Initiatives, Just Transition

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PDF ISBN: 978-92-68-19336-5 doi: 10.2833/83795 MJ-09-24-600-EN-N

Manuscript completed in July 2024

1st edition

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Luxembourg: Publications Office of the European Union, 2024

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## Introduction

This paper has been developed as part of the support provided to the Regional Economic Development Agency of Stara Zagora through the EU Coal Regions in Transition Initiatives technical assistance facility START. It is one of three reports exploring opportunities for economic development and diversification of Stara Zagora Region, within the context of the eventual phasing-out of fossil fuel-based energy generation, including cessation of lignite mining activities, and the decarbonisation of the economy. The accompanying two papers cover the development of clean hydrogen, and sustainable agriculture.

The paper has been developed using a combination of desk-based secondary research, combined with interviews with senior representatives of six organisations familiar with the situation of the local industrial (manufacturing) base and knowledge infrastructure. The report is structured as follows:

- **Section 2:** briefly describes the context of energy transition in the Stara Zagora Region, together with the national and regional development of mechatronics.
- **Section 3:** outlines the industrial structure of the economy of Stara Zagora Region and the position of mechatronics-related activities within this structure.
- **Section 4:** draws on findings from stakeholder interviews to develop an assessment of the potential of the mechatronics sector in the Stara Zagora Region.
- **Section 5:** discusses some overarching considerations for the development of mechatronics in the Stara Zagora Region.
- **Section 6:** sketches out three potential pathways for supporting the future development of mechatronics in the Stara Zagora Region.
- **Section 7:** looks at the potential to leverage the European Digital Innovation Hub “Zagore” and the SynGRDiT Project to initiate activities to support mechatronics development in Stara Zagora Region.
- **Section 8:** concludes and provides outline recommendations.

## Context

The Stara Zagora Region is one of the three geographical areas in Bulgaria that have been identified as most vulnerable to the transition away from fossil fuel energy use and the decarbonisation of the economy. This vulnerability reflects the presence of four thermal power plants (TPPs), along with accompanying lignite mining activities and supporting services, which together constitute the Region’s most important economic activity and are a major source of employment.

Faced by the eventual phasing out of lignite mining and use, mechatronics is identified in the Territorial Just Transition Plan (TJTP) for Stara Zagora Region as one of the strategic priority areas for diversification of the local economy (Pillar 3 of the TJTP), alongside the chemical industry, agriculture, industry ICT solutions, electrical components manufacturing, and clean energy. Moreover, the TJTP recognises low-carbon and sustainable mechatronics as one of the suitable fields for development of clean technologies and clean energy that can contribute to achieving the goal of decarbonisation, together with the chemical and materials industry, ICT, agriculture, tourism, generation and storage of electricity, recycling, energy efficiency services and sustainable mobility solutions.

### Description of mechatronics

It is not the intention of this paper to engage in a detailed discussion around the conceptualisation and definition of mechatronics. Essentially, for the purposes of this paper, mechatronics is understood to relate to productive activities based on the synergistic integration of mechanics, electronics and electrical engineering, control theory (systems), as well as computer science in design and production, that aims to improve and/or optimize functionality.<sup>1</sup>

Mechatronics is not a business sector but rather a technology domain that has an impact on multiple sectors. As such, it cannot be matched to usual business activity classifications, such as NACE codes. In turn, the innate transversal and disparate nature of this technological domain, makes the design and application of broad support measure for its utilisation challenging.

For analytical purposes the Bulgarian Research and Innovation Strategy for Smart Specialisation (RIS 3) defines mechatronics by reference to manufacturing sectors that predominantly rely on mechatronics, together with ICT and related consultancy and research services, including the following two-digit NACE codes:

- 26. Manufacture of computer, electronic and optical products;
- 27. Manufacture of electrical equipment;
- 28. Manufacture of machinery and equipment n.e.c.;
- 29. Manufacture of motor vehicles, trailers and semi-trailers;
- 30. Manufacture of other transport equipment;
- 62. Computer programming, consultancy and related activities;
- 63. Information service activities;
- 71. Architectural and engineering activities; technical testing and analysis
- 72. Scientific research and development.

The inclusion of mechatronics among the possible avenues for industrial transformation reflects Bulgaria's industrial past and its historical specialisation in electronics. The Bulgarian Innovation Strategy for Smart Specialisation 2014-2020<sup>2</sup>, dated from 2015, identifies 'Mechatronics and Clean technologies' as an area with future potential for accelerated technological development in the wider Southeastern Region, alongside 'New Technologies in the Creative and Recreative Industries' and 'Industry for Healthy lifestyle and BioTech'. Although, it can also be noted that 'Mechatronics and Clean technologies' is identified as an area of future potential for all Bulgarian Regions, apart from the Southwestern Region, implying it is something of a national attribute rather than being specific to one or a few regions in Bulgaria.

With specific reference to strengths relevant to 'Mechatronics and Clean technologies', the Bulgarian Innovation Strategy for Smart Specialisation 2014-2020 notes the Stara Zagora Region's R&D capacity in related fields (e.g., medical sciences, agricultural sciences, mechanics, electronics, nanotechnologies, management

systems, software to clean technologies (eco mobility) storage and energy saving), alongside sectoral capacities in 'Architectural and engineering activities', 'Consultancy in the field of management' and relevant manufacturing activities (e.g., '*Manufacture of instruments and appliances for measuring, testing and navigation*', and '*Manufacture of radio, television and communication equipment and appliances*').

The more recent POINT<sup>3</sup> Review of Industrial Transition of Bulgaria (2021)<sup>4</sup> from the European Commission's Joint Research Centre (JRC) examines the potential contribution that the emerging Bulgarian ICT sector can make to the digitalisation of manufacturing in Bulgaria and the possibilities to harness digitalisation to link and simultaneously strengthen the ICT and mechatronics sectors. The POINT Review notes that Bulgaria has production strengths in both ICT and mechatronics that date back to the 1980s, but each sector faces challenges that could be addressed by leveraging the abilities of the other sector. On the one hand, despite success in providing software solutions to international markets, domestic ICT companies have struggled to graduate to higher value-added market segments and activities. On the other hand, although they have a long experience

1. This follows the definition used in the French standard NF E 01-010 for mechatronics, that is also referenced in the [Concept for digital transformation of the Bulgarian Industry \(Industry 4.0\)](#)

2. [https://www.mi.government.bg/files/user/uploads/files/innovations/ris3\\_26.10.2015\\_en.pdf](https://www.mi.government.bg/files/user/uploads/files/innovations/ris3_26.10.2015_en.pdf)

3. Projecting Opportunities for INdustrial Transitions (POINT)

4. <https://s3platform.jrc.ec.europa.eu/documents/20125/245333/POINT+review+Bulgaria.pdf/1caa9aa4-d80a-6d73-d2c9-33beb3b9a0e9?t=1621268543150>

and established productive capabilities, mechatronics manufacturers are facing a productivity shortfall and are ripe for modernisation.

Accordingly, the POINT Review suggests that it may be worthwhile to consider government-orchestrated actions to link the two sectors, with the objective of obtaining world-class productive capabilities. The Review proposes that successfully implementing such digitalisation actions could favourably position Bulgarian ICT and manufacturing firms in global markets for advanced manufacturing solutions, while providing a platform for wider digitalisation in other areas such as clean tech, telemedicine, and tele-education.

However, the POINT Review also highlights the geographical concentration of activities in mechatronics and ICT sector around the capital Sofia and surrounding Southwestern region. For example, it estimates that in 2018, Sofia alone accounted for 44% of operating revenue of the mechatronics sector<sup>5</sup> (as compared to 12% for the Southeastern region that includes the Stara Zagora Region), within which it accounted for 87% of the operating revenues of the ICT sector and 67% of the revenues of the sector '*Manufacture of computer, electronic and optical products*'. Furthermore, some 92% of the Scientific R&D sector's annual operating revenues are concentrated in Sofia. This concentration of activities around the country's capital is seen to represent a challenge for increasing the interconnectivity between the ICT sector and relevant mechatronic-related manufacturing activities in other regions.

In so far as the POINT Review makes specific reference to Stara Zagora Region, it notes a concentrations of ICT companies, and the Stara Zagora municipality's position as an administrative centre and university city, and a centre of the national computer and microelectronics industry since the 1980s.

## The mechatronics sector in the industrial structure of Stara Zagora Region<sup>6</sup>

As previously noted, the energy sector and associated mining activities and supporting services dominate the economy of Stara Zagora Region. As concerns manufacturing, data from the Stara Zagora Chamber of Commerce<sup>7</sup>, indicate that the most important sectors are '*Manufacture of Fabricated Metal Products (NACE 25)*', which is largely attributed to the region's specialisation in the manufacture of armaments and ammunition, '*Food processing (NACE 10)*', '*Manufacture Of Machinery & Equipment n.e.c. (NACE 28)*', notably manufacture of hydraulic equipment and food processing equipment, and '*Manufacture Of Rubber & Plastic Products (NACE 22)*'; see [Table 4](#) for a detailed breakdown of manufacturing activities.

Focussing specifically on those sectors typically considered to constitute the base of mechatronics (i.e., manufacturing sectors that predominantly rely on mechatronics, together with information and computing services and other related activities), [Table 1](#) provides some insight into the size and composition of mechatronic-related activity in the Stara Zagora Region; more detailed breakdowns are provided in [Table 4](#) and [Table 5](#) (in [Annex](#)). These data indicate that '*Manufacture of Machinery and Equipment n.e.c. (NACE 28)*', with over 4.3 thousand employees and revenues of over BGN 450 million (EUR 232 million), is by far the largest component of mechatronic-related activity in Stara Zagora Region, representing an estimated 62% of mechatronic-related employment and 67% of revenues. '*Manufacture of Machinery and Equipment n.e.c. (NACE 28)*' includes five companies with 250 or more employees (see [Table 2](#)), and a further six companies with 50 or more employees.

5. For the purposes of the POINT Review, mechatronics is defined to include the following NACE 2 sub-sectors: 26. Manufacture of computer, electronic and optical products; 27. Manufacture of electrical equipment; 28. Manufacture of machinery and equipment n.e.c.; 29. Manufacture of motor vehicles, trailers and semi-trailers; 30. Manufacture of other transport equipment; 62. Computer programming, consultancy and related activities; 63. Information service activities; 72. Scientific research and development. Their analysis excludes 71. Architectural and engineering activities; technical testing and analysis, due to the focus on the provision of services and consultancy closer to the architectural field rather than the mechatronics sector.

6. Unless otherwise stated, all reported data in this section refer to 2021.  
7. Based on reported company-level data compiled for the [Economic Yearbook of Stara Zagora Region 2023](#). The analysis covers only those companies reporting above zero employment and above zero total revenues for 2021.

**TABLE 1: SIZE AND COMPOSITION OF MECHATRONICS-RELATED SECTORS IN STARA ZAGORA REGION IN 2021**

	<b>Sector (NACE 2008)</b>	<b>Number of enterprises</b>	<b>Average Annual staff</b>	<b>Total revenue (BGN million)</b>	<b>Revenue per worker (BGN thousand)</b>
26	Manufacture Of Computer, Electronic & Optical Equipment	10	490	64.3	131.3
27	Manufacture Of Electrical Equipment	18	247	12.1	49.0
28	Manufacture Of Machinery & Equipment N.E.C.	70	4,332	453.4	104.7
29	Manufacture & Assembling Of Motor Vehicles	7	683	58.3	85.3
30	Manufacture Of Other Transport Equipment	2	2	0.0	10.0
62	Computer Programming, Consultancy And Related Activities	170	556	40.8	73.5
63	Information Service Activities	47	116	5.1	43.7
7112	<i>Engineering activities and technical consulting</i>	159	357	27.9	78.1
7120	<i>Technical testing and analysis</i>	27	113	6.3	55.6
7219	<i>Research and development in the natural, medical, agricultural, and technical sciences, excluding biotechnology</i>	7	122	9.1	74.7
	<b>TOTAL (of above)</b>	<b>517</b>	<b>7,018</b>	<b>677.3</b>	<b>-</b>

Source: Authors calculations based on Stara Zagora Chamber of Commerce

**TABLE 2: FIVE LARGEST 'MANUFACTURE OF MACHINERY AND EQUIPMENT N.E.C. (NACE 28)', COMPANIES IN STARA ZAGORA REGION BASED ON REVENUES IN 2021**

Company	Activity	Average Annual staff	Total revenue (BGN million)
М+С ХИДРАВЛИК <i>M+S Hydraulics</i>	Hydraulic orbital motors, steering units, brakes, and accessories	1,221	152.9
КАПРОНИ <i>Caproni</i>	Hydraulic components and systems	781	52.7
СУПЕРАБРАЗИВ <i>Superabrasive</i>	Floor Grinding and Polishing Machines	265	42.3
БЪДЕЩНОСТ <i>Badeshtnost</i>	Hydraulic distributors and hydraulic components	330	35.9
ХРАНИНВЕСТ – ХРАНМАШКОМПЛЕКТ <i>Hraninvest HMK AD</i>	Food processing machines and equipment	436	26.6

Source: Authors calculations based on Stara Zagora Chamber of Commerce

As illustrated by Table 2, the '*Manufacture of Machinery and Equipment n.e.c. (NACE 28)*' sector has something of a specialisation in hydraulic systems and components. Concerning food processing equipment, Hraninvest HMK AD (ХРАНИНВЕСТ – ХРАНМАШКОМПЛЕКТ) is specialised in the production of stainless-steel tanks and welded support structures, and its activities may be considered more akin to the manufacture of fabricated metal products which, as noted above, constitutes the most important manufacturing sector in Stara Zagora Region.

In terms of revenues, the second largest component of mechatronic-related activity in Stara Zagora is '*Manufacture of Computer, Electronic & Optical Equipment (NACE 26)*', with just under 500 employees and revenues of BGN 64.3 million (EUR 32.9 million); although one company, VEAS Bulgaria (ВЕАС България) a part of the Videoton Group, which is specialised in contract manufacturing (assembly of printed circuit boards) accounts for more than half of the sector's revenues and employment. Other notable companies include Bultech 2000 (БУЛТЕХ – 2000), Bultech 2011 (БУЛТЕХ – 2011), and Milkotronic (МИЛКОТРОНИК), which are all manufacturers of milk analysers.

Concerning the '*Manufacture & Assembling of Motor Vehicles (NACE 29)*', the data from the Chamber of Commerce indicate that there are only two companies of significant size in the Stara Zagora Region: Oskar Rüegg Bulgaria (ОСКАР РЮЕГ БЪЛГАРИЯ), a producer of complex stamped metal parts, and Arkomat (АРКОМАТ),

a producer of wire harnesses. In addition, Standard Profile Bulgaria (СТАНДАРД ПРОФИЛ БЪЛГАРИЯ), classified under the 'Manufacture of Rubber & Plastic Products (22)', produces sealing profiles for the automotive industry and employs circa 850 workers, with a turnover of BGN 82.3 million. It is worth noting, also, that the Dutch company Nedschroef Helmond B.V, a manufacturer of high-quality fasteners and individual molding technology solutions for the automotive sector opened a new factory in 2023 that is expected to create 300 jobs.<sup>8</sup> Equally, the French company Akwel, that describes itself as a specialist in fluid Management, Mechanisms and Structural parts for electric vehicles, has recently opened a plant that should initially create 400 jobs.<sup>9</sup> Finally, Videoton Bulgaria, has announced a BGN 15 million investment to produced circuit boards for the automotive industry.<sup>10</sup>

In the sector '*Manufacture of Electrical Equipment (NACE 27)*', the main companies are Nikdim (НИКДИМ), a manufacturer of disconnectors, fuses and insulators, largely destined to the energy sector and rail transport, and Vereia Plast (ВЕРЕЯ – ПЛАСТ), a manufacturer of vacuum-tube solar collectors. In addition, early in

8. <https://invest.starazagora.bg/en/news-and-events/the-netherlands-company-nedschroef-opened-a-production-base-in-stara-zagora/>

9. <https://money.bg/investments/frenskata-akwel-zapochva-proizvodstvo-na-avtomobilni-chasti-v-stara-zagora-i-tarsi-400-dushi.html>

10. <https://money.bg/investments/proizvodstvo-na-avtomobilni-platki-v-stara-zagora-sled-investitsiya-ot-15-miliona-leva.html>



2024, the Bulgarian Smart Energy Group announced its attention to construct a factory for the production of photovoltaic panels and cells in Stara Zagora Region. Initially, the plant should employ 350 and 500 jobs, rising to 800 jobs when the plant is in full production. Interestingly, one of the factors influencing the locations decision is the expected availability of workers in the Stara Zagora Region resulting from the ending of the production of electrical energy from fossil fuels.<sup>11</sup>

The sectors of '*Computer Programming, Consultancy and Related Activities (NACE 62)*' and '*Information Service Activities (NACE 63)*' are composed mainly of small companies, of the 217 identified enterprises in these sectors, 209 have less than 10 employees, with only two enterprises with 50 or more employees: eDynamix (eДинамикс) that designs and develops software products for the automotive industry (circa 120 employees and revenues of BGN 5.4 million), and David Holding (ДАВИД ХОЛДИНГ), a provider of business software solutions and services (circa 50 employees and revenues of BGN 3.2 million).

Similarly, the sub-sectors of '*Engineering activities and technical consulting (NACE 7112)*' and '*Technical testing and analysis (NACE 7120)*' are composed largely of small companies, with only 6 enterprises having more than 10 employees and none with more than 50 employees. In terms of employment, the largest enterprises in the category of '*Research and Development ... (NACE 7219)*' are the Centre for Testing and European Certification (ЦЕНТЪР ЗА ИЗПИТВАНЕ И ЕВРОПЕЙСКА СЕРТИФИКАЦИЯ) with circa 50 employees, and Institute of Hydraulics (ИНСТИТУТ ПО ХИДРАВЛИКА), which used to be part of Caproni (КАПРОНИ), with circa 45 employees; the largest enterprise in terms of revenue is Energy Max (ЕНЕРДЖИ МАКС), a provider of technical testing for the energy sector (gas and coal).

Looking beyond the sectors typically considered to constitute the base of mechatronics, there are undoubtedly other enterprises that employ mechatronics systems within their production processes. Systematic

identification of these enterprises would require analysis that is beyond the scope of the START support. However, by way of illustrations, findings from interviews with stakeholders (see [Assessment of the potential of the mechatronics sector in the Stara Zagora Region](#) next section) identified Progress AD (Прогрес АД), a metal working company equipped with modern metalworking machines and control devices, with over 500 employees and revenues of nearly BGN 50 million in 2021. Similarly, mention was made of El Control (ЕЛ КОНТРОЛ), a company specialised in construction and installation of electrical systems for the energy sector and that is currently building a new manufacturing facility in cooperation with Siemens Ltd for whom they recently became a technology partner; the company has circa 130 staff and annual revenues of BGN 13.6 million. Finally, but by no means least, aspects of mechatronics are also applied at Arsenal AD (АРСЕНАЛ АД), a manufacturer of armaments and ammunition with circa 7,250 employees and revenues of over BGN 500 million in 2021.

11. <https://www.smartsolar.bg/en/oficialno-smart-enerdzhi-grup-stroi-zavod-za-solari-paneli-i-kletki-do-stara-zagora/>.

## Assessment of the potential of the mechatronics sector in the Stara Zagora Region

Historically, some 30 to 40 years ago, Stara Zagora had a strong association with the mechatronics sector, most notably through the Beroe plant, which designed and produced robotic systems, making some exceptional developments in the robotics field in the 1970's and the 1980's, and was the industrial leader in robotics in Bulgaria. Also, the DZU plant in Stara Zagora was a major producer of disc storage devices and had important scientific, engineering, and technical teams. The DZU plant was acquired by the Hungarian Videotron group in 1999, moving some production from Hungary in search of a cheaper workforce.

Unfortunately, little remains of the earlier knowledge and the experienced workforce that made Stara Zagora a leader in scientific and technological expertise in robotics, electrical and electronic production, and computing. Much of the supporting infrastructure – e.g., scientific and technological research, and technical educational and training facilities – has disappeared; for example, the previously existing robotics high school and technical school on chemistry have both been closed. In this regard, the cases of the Beroe and DZU plants mentioned above are illustrative of a wider 'hollowing out' of mechatronics-related expertise in the Stara Zagora Region. In the case of DZU<sup>12</sup>, its main activities are now around contract manufacturing and assembly of typically small volume and complex pieces, with a mainly low skilled female workforce undertaking manual tasks and employing very few engineering staff.

The consensus among interviewees is that, today, there are less than a handful of companies in Stara Zagora Region that can be considered (partially) to be engaged in mechatronic related development and production activities. The general assessment is that these are 'ageing' or small companies with limited development prospects, which are tending towards contraction or closure of more technologically advanced activities. Moreover, after the demise of previous large scale mechatronic related activities, interviewees point to a failure to exploit the potential to develop smaller specialised indigenous mechatronics businesses.

Local manufacturing firms tend to rely on (foreign) suppliers of machinery and equipment to modernise and introduce innovations in their production processes. Where such manufacturing businesses undertake

independent innovation activities, this tends to be conducted with support from outside Stara Zagora Region, relying mostly on contracting foreign specialists or collaborating with them. As concerns foreign investments in manufacturing and assembly activities, there seems to be no evidence of such investors locating R&D and innovation activities in the Region, which restricts opportunities for knowledge-transfer or formation of links to potential local technology suppliers and expertise. Consequently, these investments offer little opportunity for local affiliate enterprises to engage in innovation and new product development.

Interviewees noted, also, weaknesses in the education and qualification levels of the workforce in Stara Zagora Region. Data from the National Map for Higher Education 2023<sup>13</sup>, which provides a breakdown by NUTS 2 region, indicates that although the Southeastern region accounts for 14.7 percent of the population, the region's share of total active university students is only 6.9 percent. Similarly, although 14.4 percent of Bulgarian students studying at universities in the country come from the Southeastern region, only 7.1 percent of Bulgarian university students pursue their studies in the region.<sup>14</sup> This is partially offset by the fact that a somewhat higher proportion of graduates come to work in the Southeastern region, with data from the National Map indicating that 10.4 percent of students with Bulgarian citizenship that graduated from higher education institutions in Bulgaria during the period 2018 – 2022 found work in the Southeastern region.<sup>15</sup> Nonetheless, this figure remains somewhat below the 14.4 percent of Bulgarian students coming from the region, indicative of a net 'brain drain' of young educated persons from the region. One explanatory factor for the low share of graduates is an apparent preference for recent graduates to go to work in Sofia or abroad.

12. DZU AD, is the managing and controlling company for three Videotron businesses: VEAS BG Ltd. (contract electronics manufacturing services), VTBH Ltd. (assembly of household appliances and other electrical subassemblies and final products), and VT BULPLAST Ltd. (plastics mouldings for electronics and consumer goods industries)

13. <https://www.strategy.bg/StrategicDocuments/View.aspx?lang=bg-BG&Id=1653>

14. Here, 'Bulgarian students' refers to active students with that are Bulgarian citizens. 'Students from the Southeastern region' refers to active students that graduated from secondary education in the Southeastern region.

15. Socially insured Bulgarian citizens who graduated from higher education institutions in Bulgaria in the period 2018-2022 according to the planning region in which their workplace is located.

### Stakeholder interviews

To support an assessment of the potential of mechatronics as a component of the development and economic diversification of Stara Zagora Region, the START team conducted interviews with senior representatives seven organisations to gather information and opinions about mechatronics-related activities in the region. The interviews were conducted in March and April 2024 and covered the following organisations:

- Ate Plast Ltd
- Bultech 2000 Ltd
- M+S Hydraulic
- Milkotronic Ltd
- Videoton
- Mechatronics and Automation Cluster
- Faculty of Engineering and Technology, Trakia University

**TABLE 3: NUMBER OF ACTIVE STUDENTS FOR THE ACADEMIC YEAR 2022/2023**

PN	Speciality	Number of students		% of students at national level
		Southeastern region	National Total	
406	Informatics and Computer Science	154	7,181	2.1%
501	Mechanical Engineering	550	3,021	18.2%
502	Electrical engineering, electronics and automation	672	4,194	16.0%
503	Communication and computer technology	513	7,259	7.1%
504	Energy	282	1,297	21.7%

Source: National Map for Higher Education 2023

Business representatives point to the shortage of engineers, together with other professionally qualified persons (e.g., mechanics, programmers, chemists) as a problem. Moreover, the existing vocational training infrastructure is considered inadequate, with businesses needing to train their own staff or send them outside (abroad) to receive training. They also point to weaknesses in internship programs, characterised by difficulties to attract and retain students after they complete their internships, as they prefer to look for career opportunities outside the region, especially in Sofia or abroad.

In terms of higher education, the Technical University of Sofia is acknowledged as a key centre for specialist education in the field of mechatronics. However, as noted earlier, businesses in Stara Zagora Region point to the difficulty they have in attracting and retaining qualified staff from outside the region. Some effort has been made to address this issue through the establishing of branches outside the capital, including a technical college in Kazanlak.

In comparison, Trakia University is more recognised for its capacities in agriculture and veterinary medicine, along with human medicine and education. While this expertise is well acknowledged, several interviewees have the perception that the University is not providing education relevant to much of the industrial base of Stara Zagora Region. In the recent years, as part of the University's agricultural specialisation, a new course has been introduced on mechatronics in the agricultural sector. Also, the University offers limited engineering specialities and has a faculty of 'Technics and Engineering', with a technology faculty based in Yambol, including the vocational technical school "Ivan Raynov". Although the University provides some courses relevant to mechatronics, representatives from the University indicate that opening of a fully-fledged mechatronics specialty would require serious preliminary study to develop curricula adequate to meet new conditions, alongside upgrading of the University's material and technical facilities.

At the level of the Southeastern region, in terms of mechatronics-related disciplines, the National Map for Higher Education 2023<sup>16</sup> indicates a relative specialisation in terms of student numbers in the fields of 'Energy', 'Mechanical Engineering' and, to a lesser extent, 'Electrical engineering, electronics and automation' (see [Table 3](#)). However, it is equally apparent that Southeastern region accounts for only a very small proportion of students studying 'Informatics and Computer Science' and is lagging in 'Communication and computer technology'. This reinforces the impression of a regional weakness in the ICT sector, with a potential disconnect of academic capacities in engineering and energy from the complementary ICT-related capacities associated with mechatronics-related research and innovation.

One potential future development that has been floated is the creation of a joint laboratory between Trakia University and the Institute of Information and Communication Technologies based in Sofia, which would be equipped with 3D digitisation and scanning. Such a development could lay the foundation for cooperation and the uptake of new technologies and their introduction into production processes of local businesses. This would require strengthening of the linkages between the academic and business communities, enabling the transfer of research outputs and their integration into production processes and products. In this context, it is worth noting that the Cluster Mechatronics and Automotive (CMA)<sup>17</sup>, has also indicated its intention to open training centres for mechatronics and automation in Kazanlak and Stara Zagora.

Overall, however, findings from the interviews with stakeholders suggest that Stara Zagora Region is seen currently as lacking the qualified and experienced scientists, engineers, mechanics, and programmers who could provide the basis for promoting the development of mechatronics-related activities. This makes endogenous development of mechatronics unlikely, while limiting the possibility that foreign companies investing in manufacturing and assembly activities may, eventually, decide to co-locate some development and innovation activities in Stara Zagora Region. Rather, as illustrated by recent and planned investments mentioned in the previous section of this report, it is expected that Stara Zagora Region will primarily be attractive for inward investments in low and medium skilled production activities.

Consequently, Stara Zagora Region faces something of a "chicken and egg" problem. On the one hand, the lack of a qualified and experienced workforce makes it difficult to attract mechatronics-related development and innovation

activities. On the other hand, the absence of enterprises engaged in mechatronics-related business development implies a consequential lack of local jobs and career opportunities that, in turn, limits demand for education and training in mechatronic-related fields, thereby reducing the interest of academic and training institutions to develop corresponding services.

Nevertheless, even if there appear to be structural deficiencies in the local manufacturing base, Stara Zagora Region has production strengths and the presence of medium to large enterprises in some sub-sectors such as hydraulic engineering, food-processing machinery, energy systems, and increasingly automotive components that could offer a foundation around which the development of mechatronic-related activities could coalesce. This would call, however, for conscious development of business strategies and investments to make a shift from low- and medium-technology industrial processes and products, towards production requiring the development and introduction of high-tech capabilities employing mechatronic systems and solutions. At the same time, given the apparent limited size and strength of computing and information technology activities in the Stara Zagora Region, and as identified in the POINT Review mentioned previously, one challenge will be to increase the interconnectivity between (potential) mechatronic-related manufacturing activities and the ICT sector that is primarily located outside the region. Assuming these obstacles can be overcome, development of mechatronic-related activities would need to go hand-in-hand with market development, to raise awareness in the market of production capabilities and create demand for the products of enterprises located in Stara Zagora Region.

The above assessment does not, however, point to an obvious role for mechatronics-based development and diversification in the creation of significant job opportunities that could directly mitigate the negative impacts of the shift away from traditional fossil-fuel based activities (i.e. lignite mining and thermal power generation). The consensus from interviewees seems to be that some persons working in the thermal power plants may have expertise and experience relevant to mechatronics (e.g., electrical engineering and electronics) but that numbers are limited, while it is unlikely that former miners would have skills relevant to mechatronics.

As noted previously, there are several recently announced manufacturing production and assembly investments – although none specifically associated with mechatronics – that could create significant employment opportunities which with appropriate retraining could be suitable for displaced workers from the mining and energy sectors but not necessarily with commensurate pay and employment conditions.

16. <https://www.strategy.bg/StrategicDocuments/View.aspx?lang=bg-BG&id=1653>

17. <https://www.cluster-mechatronics-automation.com/en>

## Overarching considerations for the development of mechatronics in the Stara Zagora Region

Mechatronics features as an important development priority for Stara Zagora Region in its Territorial Just Transition Plan and as part of the national smart specialisation strategy. Moreover, there are ongoing initiatives – such as the European Digital Innovation Hub and SynGReDiT Project (see [Initiation of activities towards development of mechatronics in the Stara Zagora Region: EDIH “Zagore” and SynGReDiT](#)) – that could play an important role in supporting the development of mechatronics-related activities in the region. However, as indicated in the previous sections, the apparent potential base for development of mechatronic-related activities in Stara Zagora Region is currently quite limited. On the one hand, the existing capacities – both in terms of business activities and the institutional scientific knowledge base – in electronics, computing, and information technologies appears to be relatively narrow. On the other hand, although there are strengths in certain ‘niche’ manufacturing activities, notably hydraulics systems and components, there are relatively limited manufacturing activities that would intuitively be associated with a significant application of mechatronics in their products or in the development of production processes. And, as noted previously, manufacturing companies in Stara Zagora Region tend to rely on external (foreign) suppliers of machinery and equipment to modernise and introduce innovations in their production processes, while for local affiliates of foreign companies, product development and innovation activities are generally located outside of Bulgaria.

To some extent, the situation of Stara Zagora Region can be contrasted with that of Plovdiv that, according to the POINT Review<sup>18</sup> is home to the largest number of mechatronics companies outside of Sofia. Plovdiv (including the Trakia Economic Zone and Assenovgrad) has an established dynamic and innovative ICT eco-system formed around ‘Computer programming, consultancy and other IT services’, ‘Wholesale of computer, electronic and telecommunication equipment and software’ and ‘Manufacture of electronic components and boards’. It is also the country’s second most important location for R&D activities and home to several key mechatronic research and technology development institutions such as the Research Centre in Mechatronics and Clean Technologies (part of the Central Laboratory

of Applied Physics of BAS), The Institute of Robotics (also part of BAS), and the Centre of Competence “Smart Mechatronic, Eco- and Energy Saving Systems and Technologies” (part of the Technical University of Sofia). In parallel, while Plovdiv has seen a contraction of employment in traditional manufacturing activities in textiles and clothing, and the food and beverage sector, and only slow growth in process industries (metals, chemistry, cosmetics, etc.), it has successfully managed substantial expansion in mechatronics and the automotive sector, primarily driven through foreign investments.

Considering the prominence of Sofia and its surrounding areas, and the apparent success of Plovdiv in developing itself as a pole for mechatronic-related activities, the wisdom of promoting mechatronics as a key strategic priority area for diversification of the economy of Stara Zagora Region would appear to warrant careful reflection. The tendency towards the agglomeration of manufacturing and development activities in areas with an established knowledge base and supporting infrastructure, and an experienced and qualified workforce, appears to present a considerable barrier to the development of significant mechatronic activities in Star Zagora Region.

In this context, it would seem appropriate to consider the potential opportunity costs of mechatronics development when there exist other potential development axes. Notably, clean hydrogen production and sustainable agriculture, which are addressed in accompanying START reports, together with other sectors such as those identified in the TJTP (e.g., chemical industry, industry ICT solutions, electrical components manufacturing and clean energy). Equally, with European countries acknowledging the need to augment defence spending accompanied by recognition of the shortage of production capacity in the European defence sector, there may well be opportunities to strengthen manufacturing capacity for armaments and ammunition in Stara Zagora Region.

This is not to say that mechatronics is not important but, rather, that mechatronics-related development should perhaps be seen as an accompanying element of the development of activities in other domains, rather than a specific focus in its own right. There is a precedent for this type of development in the area of agriculture with, as noted earlier, the introduction of a course on mechatronics in the agricultural sector and a research programme on robotics in large-scale livestock farming at the University of Trakia. Alongside agriculture, energy – particularly renewable energies including clean hydrogen, and new technologies in areas such as energy efficiency and energy management – could also be a field in which synergies with the mechatronic-related development could be realised.

18. Source: <https://s3platform.jrc.ec.europa.eu/documents/20125/245333/POINT+review+Bulgaria.pdf/1caa9aa4-d80a-6d73-d2c9-33beb3b9a0e9?t=1621268543150>

## Potential pathways for development of mechatronics in the Stara Zagora Region

Taking account of the findings and observations from the preceding assessment of the situation and potential, three potential pathways for development of mechatronics in Star Zagora Region are outlined below.

### Pathway 1: Raising awareness and promoting adoption of mechatronic technologies

#### Exogenous development and osmotic technology transfer.

This pathway would primarily aim to raising awareness across manufacturing and engineering businesses in Stara Zagora Region of the potential application of mechatronics in their production processes and products. This could be envisaged as an element of the modernisation of industry, with the utilization of mechatronics to upgrade production activities, raise productivity, and help to position manufacturing activities in higher value-added market segments.

Such a pathway would not rely on the explicit development of mechatronic capacities within Stara Zagora Region but instead encourage investments in machinery, equipment and systems integrating mechatronics using 'external' suppliers. This could see a reinforcement of current business practices, whereby local manufacturing and assembly activities rely on (foreign) suppliers of machinery and equipment and other technology specialist to modernise production processes and engage in innovation activities.

As a first element, this pathway would envisage actions to raise awareness among businesses in the Stara Zagora Region of the potential opportunities for application of mechatronics in their production processes and products, together with the potential economic benefits of mechatronic-related investments. A programme of awareness raising activities could, for example, integrate elements such as presentation of good practice examples, business seminars, field visits, and, eventually, provision of tailored company specific expert advice and audits. Such an awareness raising programme could, for example, be developed and coordinated by the Regional Economic Development Agency in collaboration with business representative organisations (e.g., Chambers of Commerce), and draw on specialist expertise and experience from the academic community, but also existing mechatronic-related cluster organisations and private businesses with hands-on experience of employing mechatronics in their production processes and products.

A second element of this pathway would be to take steps to address the lack of a suitably qualified and experienced workforce. As noted above, the development of tertiary level vocational education and training appears to present something of a conundrum, and the appropriate balance between education programmes targeted towards new graduates and those focussed on upskilling and reskilling of existing workers is unclear. Accordingly, a preliminary assessment of potential options to strengthen mechatronic-related vocational education and training seems necessary; this could consider opportunities to reinforce knowledge and expertise in the local tertiary education bodies but, also, possibilities for private-sector led training and skills development approaches. In each case, consideration should be given to the provision of appropriate technical facilities and material resources necessary to support students/trainees to be equipped with necessary practical/applied skills and experience.

A further element of this pathway that needs to be considered is the role of public financing instruments to support mechatronic-related investments. The TJTP for Stara Zagora Region recognises that mechatronics could be a suitable vector for development of clean technologies and clean energy, which could offer scope for development of a support programme (e.g., grants or soft-loans) specifically targeted towards mechatronics-related investments. However, in this context, the main needs of manufacturing businesses in Stara Zagora Region appear to be for investments to modernise and raise productivity, rather than being specifically focussed on development of capacities in clean technologies and clean energy.

### Pathway 2: Developing strategic (external) partnerships to foster the development of mechatronics

#### Partnership-based development and conscious technology transfer.

This pathway involves a more active approach to development of mechatronic-related activities than Pathway 1. Specifically, it would aim to initiate and build cooperative partnerships between businesses in Stara Zagora Region and already existing (national or international) mechatronics clusters or 'poles of expertise' in areas relevant to the local industrial base, with the purpose of facilitating knowledge transfer from outside the region that can support the build-up of mechatronic development capabilities and applications in priority sectors.

A first (preliminary) element of this pathway would be to implement a comprehensive assessment of productive strengths and assets in Stara Zagora Region to identify those sectors or manufacturing activities with

the greatest potential for application of mechatronics and development of mechatronic-related capabilities, including ones of interest to current or possible future foreign direct investors. The assessment would cover also establishing the interest, willingness, and capacity of enterprises in the region to participate in mechatronic development and innovation activities. The aim of the assessment would be to identify the most promising intervention areas and to support the development of targeted support measures to build strategic partnerships between selected regional business sectors and relevant mechatronics clusters or 'poles of expertise'.

Alongside the demand-side assessment outlined above, a further (preliminary) element of this pathway would be a corresponding identification and assessment of potential supply-side partners with the interest, expertise, and capacity to develop a cooperative partnership with enterprises in the Stara Zagora Region. This could cover, for example, Bulgarian-based initiatives such as the Cluster Mechatronics and Automotive (CMA) or the recently created "National Centre of Mechatronics and Clean Technologies", based at the Bulgarian Academy of Sciences, which has received a grant of almost €30 million from the European Regional Development Fund (ERDF). Equally, it could look more widely, to identify opportunities to build partnerships with international mechatronic 'poles of expertise' or clusters.

The preliminary activities could, for example, be developed and coordinated by the Regional Economic Development Agency in collaboration with business representative organisations (e.g., Chambers of Commerce), and may be implemented using expertise from the academic community or through other technical assistance or consultancy mechanisms. Having identified and prioritised options for partnership development, outreach activities would need to be undertaken to both mobilise relevant local business and potential 'poles of expertise' or clusters, and to facilitate the formation and implementation of working partnership agreements. There would also be a need to identify sources of finance, at least for initial development of the partnership(s), which could include support to SME participants to accompany their development and implementation of mechatronic-related projects and innovations.

Eventually, such partnership development could form the basis for collaborative activities between businesses from Stara Zagora Region with businesses outside the region, nationally or internationally.<sup>19</sup> The partnership-based development approach could, also, become an element of the business proposition to encourage mechatronic-related direct investments in the Region, highlighting

priority areas for the attraction of investments. Ideally, this could be accompanied by a support programme (e.g., grants or soft-loans) specifically targeted towards mechatronics-related investments in these priority areas.

### Pathway 3: Initiating mechatronic technology development in key sectors

#### Endogenous development and 'own' generation of technology

This pathway would primarily aim at the development of a mechatronic knowledge base and technology development capabilities within Stara Zagora Region, with a focus on one or a few specific application domains that reflect the specialisations of the Region's existing industrial base, and/or that would support of emerging priority areas for diversification of the local economy, notably in the direction of clean technologies.

The eventual ambition would be to create a mechatronics cluster in Stara Zagora Region, capable of creating a value chain of activities linking research and technology development to industrial application, either to support the development and diversification of indigenous manufacturing or as part of a regional proposition to attract higher added-value, technology-orientated (foreign) inward direct investment.

This pathway presupposes a willingness of regional administrations, with corresponding national-level support, to actively address shortcomings in the mechatronics-related scientific and technical knowledge base and infrastructure in the Stara Zagora Region. Essentially, it would involve developing Stara Zagora Region as a 'centre of excellence' for mechatronics – which could be targeted to specific applications relevant to the existing industrial base or of strategic significance for future development – through the development of necessary research, innovation, and education/training capacity within the region, enabling the region to be equipped with adequate capabilities and infrastructure to foster and sustain endogenously-led development of mechatronics activities. In turn, this would imply conscious policies to support mechatronics activities beyond their current poles of development (e.g., Sofia and surrounding areas, Plovdiv, ...).

In addition, a key element for the viability of this pathway would be to actively promote the commercialisation of outputs from the 'centre of excellence', which could be achieved through a combination of knowledge transfer to existing enterprises within the Stara Zagora Region, the promotion of spin-off or spin-out business from the academic research base, or through the attraction of direct investments from businesses wanting to take advantage of specialist local mechatronics-related

19. See, for example, Mechatronics for SMEs project: [https://ec.europa.eu/regional\\_policy/en/projects/europe/mechatronics-for-smes-forms-networks-of-german-and-dutch-businesses](https://ec.europa.eu/regional_policy/en/projects/europe/mechatronics-for-smes-forms-networks-of-german-and-dutch-businesses)

expertise and infrastructure. In this regard, one of the key success factors for this pathway would rest on the ability to ensure positive spillovers from public-sector activities to the companies located in the Region, and between companies themselves.

In this regard, the mechatronics-related knowledge and research base established in Stara Zagora Region would be positioned as a 'public good' that is widely accessible to companies in the region, and beyond. Ideally, to promote this development, it would be accompanied by the availability of financial support mechanisms for technology development and innovation that could support the full cycle of development activities from research, to proof of concept, to demonstration and scaling-up, until reaching commercialisation.

## Initiation of activities towards development of mechatronics in the Stara Zagora Region: EDIH "Zagore" and SynGReDiT

At this point it is worth noting the potential of the European Digital Innovation Hub (EDIH) "Zagore", which has the mission to promote and support digitalisation and innovation in the Southeastern region, and the SynGReDiT Project designed to provides services and resources to businesses and public sector entities to promote decarbonisation and a dual green and digital transformation. The focus of these initiatives is on enhancing digital capabilities, fostering innovation, and supporting SMEs, which are all crucial elements for promoting the growth of the mechatronics industry in Stara Zagora and the wider Southeastern Region. Moreover, mechatronics and clean technologies (MCT) have already been identified as a priority area of intervention for EDIH "Zagore",



### EDIH “Zagore” and the SynGReDiT Initiative

The European Digital Innovation Hub (EDIH) “Zagore”<sup>20</sup>, which is part of the EDIH Network, was established in April 2021 and aims to promote digital and green solutions as mechanisms to transform and modernize both the private and public sectors in the Southeastern region, specifically for small and medium-sized enterprises, public institutions, and start-up businesses. This mission of EDIH “Zagore” covers *inter alia*:

- **Decarbonisation:** to support and promote projects and initiatives that reduce the negative ecological footprint and support decarbonization.
- **Innovation:** to support entrepreneurs, scientific researchers and start-up companies by providing the necessary resources and platforms for the development of new ideas, technologies and products.
- **Regional cooperation:** to building partnerships and knowledge exchange to strengthen the regional and international innovation network.
- **Supporting top priorities:** to fostering innovation and development in priority areas – identified as mechatronics and clean technologies (MCT) and life and health science (LHS) –thereby supporting the diversity and specialisation of the region’s economy.

SynGReDiT (Synergy for green regional digital transformation)<sup>21</sup> is a project of EDIH “Zagore” that aims to address the overall change in the long-term established industrial traditions and business interdependencies of the economy of the Southeastern region. Alongside targeting leading sectors – electricity production, various industrial productions, agriculture, transport and healthcare – the Project aims to develop sectors with a smaller share, as well as the attraction of new segments based on industrial symbiosis.

The Hub provides services in four main areas: digital skills training; testing before investing (pre-testing of innovative, green and digital solutions); support to find investments; and access to a network of innovation ecosystems. While the specific goals set for the SynGReDiT Project cover:

- Promotion of industrial and regional policies for SMEs to support business and public sector in the dual green and digital transformation to slow down climate change and restore the environment through a set of regional awareness initiatives – Ideation Labs.
- Deployment of the 3 key areas of digital technologies: High-performance computing (HPC), Direct attached storage (DAS), and cyber security and their best use for dual green and digital transformation in critical sectors for the regional economy.
- Improved access to innovation ecosystems of regional SMEs, small mid-caps, entrepreneurs, start-ups and the public sector and support to find investment through networking events and consultancy services.
- To improve access to all key areas of HPC, DAS, AI (artificial intelligence), and cyber security by collaborating with the EU EDIH network.

Both EDIH “Zagore” and the SynGReDiT are led by the Regional Economic Development Agency of Stara Zagora (SZ REDA) with partners from academia, public administrations, business representative organisations and the private sector.

20. <https://edih-zagore.eu/>

21. <https://edih-zagore.eu/proekti/syngredit/>

Leveraging the capabilities, infrastructure, and resources of EDIH “Zagore” and the SynGreDit project could provide the basis for significantly boosting the development of the mechatronics sector in Stara Zagora Region. Potential areas for developing synergies between EDIH “Zagore”, SynGreDit, and mechatronics-related activities include:

#### 1. Digital Skills and Training Programs:

- SynGreDit provides comprehensive digital skills training programs that cover advanced technologies like AI, machine learning, and robotics, which are integral to mechatronics.
- EDIH “Zagore” is focused on upskilling the workforce in digital technologies through workshops, training sessions, and certification programs. This includes specific training modules tailored for the mechatronics sector.

#### 2. Support for SMEs:

- SynGreDit offers technical assistance and innovation consultancy to SMEs, helping them integrate digital solutions into their operations. This support is critical for companies looking to adopt advanced manufacturing technologies, including mechatronics.
- EDIH “Zagore” provides SMEs with access to state-of-the-art digital tools and technologies, facilitating the development and implementation of innovative products and production processes, including mechatronic systems.

#### 3. Research and Development (R&D) Infrastructure:

- SynGreDit fosters collaborations between research institutions and industry, helping to create a robust R&D ecosystem. This collaboration can lead to the development of cutting-edge mechatronic solutions and technologies.
- EDIH “Zagore” supports the establishment of joint laboratories and innovation centres, providing the necessary infrastructure able to enable advanced mechatronics research and development.

#### 4. Innovation and Technology Transfer:

- SynGreDit facilitates technology transfer from research institutions to the industry, and could ensure that innovative mechatronic technologies are effectively commercialized and adopted by local businesses.
- EDIH “Zagore” acts as a catalyst for innovation by promoting the exchange of knowledge and best practices between companies and research entities, which could serve to enhance the region’s capacity to innovate in the mechatronics field.

#### 5. Financial Support and Investment:

- SynGreDit provides access to funding opportunities and financial instruments, such as grants and low-interest loans, that could support the development and implementation of mechatronic projects.
- EDIH “Zagore” helps attract investments by showcasing the potential of digital and mechatronic innovations, thereby helping secure financial support for local businesses and startups, including in the mechatronics sector.

If these potential synergies can be effectively developed and exploited, they could have a significant impact on the development of mechatronics-related activities and businesses within the region, such as:

- **Workforce Development:** The combined training and upskilling efforts of SynGreDit and EDIH “Zagore” can create a highly skilled workforce capable of driving innovation in the mechatronics sector.
- **Enhanced Competitiveness:** By integrating advanced digital technologies and fostering innovation, local companies active in mechatronics sector or utilising mechatronics in their production processes and products will become more competitive both nationally and internationally.
- **Increased R&D Capacity:** Improved R&D infrastructure and stronger industry-academia collaborations can lead to the development of new and advanced mechatronic solutions.
- **Economic Growth:** Modernising industry through the adoption of mechatronics and strengthening indigenous mechatronics capabilities – including through the creation and growth local mechatronics businesses – will contribute to the diversification and resilience of the regional economy, creating new job opportunities and stimulating economic development.

Overall, through the EDIH “Zagore” and SynGreDit initiatives, the Stara Zagora Region is well-positioned to significantly enhance the development of the mechatronics sector. By focusing on digital skills, supporting SMEs, fostering R&D, facilitating technology transfer, and attracting investments, these initiatives could substantially help in establishing Stara Zagora as a hub for mechatronic innovation and excellence.

## Concluding remarks and recommendations

This report has attempted to assess the current situation of mechatronics-related activities in Stara Zagora Region and the potential of mechatronics to contribute to the future development of the Region. As noted in the report much of the historical strength of Stara Zagora region in mechatronics related fields – e.g., robotics, electronics, computing, and information technologies – has all but disappeared. However, the region retains a significant industrial base both in manufacturing and associated to the energy sector, albeit in need of modernisation and greater innovation capacity. Development of the mechatronics sector in Stara Zagora region could make a significant contribution to addressing these shortcomings, while also bringing significant benefits across the whole economy, including the public and private service sectors.

As indicated in [Potential pathways for development of mechatronics in the Stara Zagora Region](#) there are several potential pathways for development of mechatronics but if the Region's ambition is to create a dynamic and locally anchored mechatronics sector it will require coordinated efforts in education, infrastructure, and strategic partnerships. By addressing these areas, Stara Zagora Region can build on its industrial strengths to establish a mechatronics sector able to contribute significantly to the region's economic diversification and resilience. To achieve this development, which may adopt an approach of specialisation in priority fields such as clean technologies, the following recommendations to stakeholders are worth considering alongside the three potential pathways noted in [Potential pathways for development of mechatronics in the Stara Zagora Region](#) of this report:

- 1. Enhanced Collaboration:** strengthen partnerships between local businesses and national/international mechatronics clusters to foster knowledge transfer and innovation.
- 2. Workforce Development:** invest in vocational and higher education programs tailored to mechatronics, including partnerships with universities and technical schools to develop specialised curricula.
- 3. Infrastructure Investment:** develop research and technology support infrastructure, such as joint laboratories and technology centres, to support mechatronics R&D and innovation activities.
- 4. Financial Support:** create funding mechanisms, such as grants or soft loans, to support mechatronics-related investments and encourage the adoption of advanced technologies.
- 5. Policy and Strategy Alignment:** ensure alignment of regional strategies with national policies, leveraging programmes like the Research, Innovation, and Digital Transformation Programme to support local mechatronics-related initiatives.

## Annex

The tables in this annex are based on reported company-level data compiled for the Economic Yearbook of Stara Zagora Region 2023. The analysis covers only those companies reporting both above zero employment and above zero total revenues for 2021.

**TABLE 4: COMPOSITION OF MANUFACTURING SECTOR (INCLUDING REPAIR AND INSTALLATION) IN STARA ZAGORA REGION, NACE 2-DIGIT SECTORS RANKED BY TOTAL REVENUE IN 2021**

		Number of enterprises	Average Annual staff	Total revenue (BGN million)	Revenue per worker (BGN thousand)
<b>25</b>	<b>Manufacture Of Fabricated Metal Products</b>	<b>220</b>	<b>11,584</b>	<b>920.8</b>	<b>79.5</b>
2540	<i>Manufacture of armaments and ammunition</i>	3	7,360	515.6	70.1
2511	<i>Manufacture of metal structures and parts thereof</i>	37	1,065	139.2	130.7
2562	<i>Mechanical processing of metal</i>	86	1,476	98.9	67.0
2592	<i>Manufacture of light metal packaging</i>	4	538	83.1	154.5
2599	<i>Manufacture of other fabricated metal products n.e.c.</i>	42	558	54.9	98.4
	<i>Other</i>	48	587	29.1	49.5
<b>10</b>	<b>Food Processing</b>	<b>249</b>	<b>3,831</b>	<b>633.1</b>	<b>165.3</b>
1091	<i>Production of prepared feeds (feedingstuffs) for farm animals</i>	6	229	149.6	653.4
1041	<i>Manufacture of vegetable and animal oils and fats free of margarine</i>	6	263	133.9	509.1
1012	<i>Poultry meat production and processing</i>	7	656	110.6	168.6
1039	<i>Processing and preserving of other fruit and vegetables excluding prepared meals</i>	23	719	68.6	95.4
1013	<i>Production of meat products without ready meals</i>	3	228	67.9	297.7
	<i>Other</i>	204	1,736	102.6	59.1

		<b>Number of enterprises</b>	<b>Average Annual staff</b>	<b>Total revenue (BGN million)</b>	<b>Revenue per worker (BGN thousand)</b>
<b>28</b>	<b>Manufacture Of Machinery &amp; Equipment N.E.C.</b>	<b>70</b>	<b>4,332</b>	<b>453.4</b>	<b>104.7</b>
2812	<i>Manufacture of hydraulic pumps, hydraulic and pneumatic motors</i>	13	2,701	265.3	98.2
2893	<i>Manufacture of food, beverage and tobacco processing machinery and equipment</i>	14	687	53.7	78.2
2849	<i>Manufacture of other machine-tools</i>	3	273	42.5	155.7
2813	<i>Manufacture of other pumps and compressors</i>	3	243	22.9	94.2
2814	<i>Manufacture of reinforcement products</i>	1	27	19.7	730.2
	<i>Other</i>	36	401	49.3	122.9
<b>22</b>	<b>Manufacture Of Rubber &amp; Plastic Products</b>	<b>63</b>	<b>2,491</b>	<b>362.4</b>	<b>145.5</b>
2221	<i>Manufacture of plastic sheets, plates, tubes and profiles</i>	5	301	125.6	417.3
2222	<i>Manufacture of plastic packaging</i>	11	569	94.9	166.9
2219	<i>Manufacture of other rubber products</i>	10	1,046	93.8	89.7
2229	<i>Manufacture of other plastic products</i>	18	361	30.1	83.4
2223	<i>Manufacture of builders' joinery and other products of plastics</i>	19	214	17.9	83.9
<b>16</b>	<b>Manufacture Of Wood &amp; Wood Products</b>	<b>55</b>	<b>867</b>	<b>198.3</b>	<b>228.7</b>
1621	<i>Veneer and wood board industry</i>	2	422	156.0	369.7
1624	<i>Manufacture of wood packaging</i>	7	222	26.7	120.5
1629	<i>Manufacture of other products of wood, manufacture of articles of cork, straw and plaiting materials</i>	34	152	11.0	72.1
	<i>Other</i>	12	71	4.6	65.0

		Number of enterprises	Average Annual staff	Total revenue (BGN million)	Revenue per worker (BGN thousand)
<b>11+12</b>	<b>Manufacture Of Beverages &amp; Tobacco Products</b>	<b>38</b>	<b>886</b>	<b>148.0</b>	<b>167.0</b>
1105	<i>Production of beer</i>	2	414	125.8	303.8
1102	<i>Manufacture of wine from grapes</i>	8	313	16.0	51.0
1107	<i>Manufacture of soft drinks, mineral and other bottled waters</i>	8	87	4.1	47.5
	<i>Other</i>	20	72	2.1	29.3
<b>20+21</b>	<b>Manufacture Of Chemicals &amp; Chemical Products (Incl. Pharmaceuticals)</b>	<b>37</b>	<b>653</b>	<b>115.1</b>	<b>176.2</b>
2053	<i>Production of essential oils</i>	15	292	37.7	129.0
2041	<i>Manufacture of soap, washing, cleaning and polishing preparations</i>	6	148	23.2	157.0
2059	<i>Manufacture of other chemical products n.e.c.</i>	5	60	22.9	382.4
	<i>Other</i>	11	153	31.2	204.0
<b>23</b>	<b>Manufacture Of Other Non-Metalic Products</b>	<b>38</b>	<b>547</b>	<b>80.3</b>	<b>146.8</b>
2362	<i>Manufacture of articles of plaster for construction</i>	1	108	44.4	410.7
2363	<i>Production of ready-mixed concrete</i>	7	207	21.9	106.0
	<i>Other</i>	30	232	14.0	60.4
<b>31</b>	<b>Manufacture Of Furniture</b>	<b>95</b>	<b>1,271</b>	<b>75.4</b>	<b>59.3</b>
3109	<i>Manufacture of other furniture</i>	55	636	36.3	57.1
3102	<i>Manufacture of kitchen furniture</i>	19	553	35.2	63.6
	<i>Other</i>	21	82	4	47.7

		Number of enterprises	Average Annual staff	Total revenue (BGN million)	Revenue per worker (BGN thousand)
<b>26</b>	<b>Manufacture Of Computer, Electronic &amp; Optical Equipment</b>	<b>10</b>	<b>490</b>	<b>64.3</b>	<b>131.3</b>
2612	<i>Manufacture of PCB mounted</i>	1	251	34.3	136.8
2651	<i>Manufacture of instruments and apparatus for measuring, testing and navigating</i>	7	221	29.2	132.2
	<i>Other</i>	2	18	0.8	43.9
<b>13</b>	<b>Manufacture Of Textiles</b>	<b>29</b>	<b>766</b>	<b>62.8</b>	<b>82.0</b>
1310	<i>Preparation and spinning of textile fibres</i>	7	516	47.0	91.0
1320	<i>Fabric production</i>	3	156	11.3	72.3
	<i>Other</i>	19	94	4.5	48.4
<b>29</b>	<b>Manufacture &amp; Assembling Of Motor Vehicles</b>	<b>7</b>	<b>683</b>	<b>58.3</b>	<b>85.3</b>
2932	<i>Manufacture of other parts and accessories for motor vehicles</i>	4	578	45.7	79.0
2920	<i>Manufacture of coupes and bodies for motor vehicles, manufacture of trailers and semi-trailers</i>	2	70	9.5	136.0
2931	<i>Manufacture of electronic and electrical parts and devices for automobiles</i>	1	35	3.1	87.7
<b>24</b>	<b>Manufacture Of Basic Metals</b>	<b>5</b>	<b>622</b>	<b>56.8</b>	<b>91.3</b>
2451	<i>Cast iron casting</i>	2	618	56.6	91.5
	<i>Other</i>	3	4	0.2	61.3
<b>17</b>	<b>Manufacture Of Paper &amp; Paper Products</b>	<b>11</b>	<b>340</b>	<b>50.9</b>	<b>149.6</b>
1721	<i>Manufacture of corrugated paperboard and packaging of paper and board</i>	6	297	45.3	152.6
	<i>Other</i>	5	43	6	128.6

		<b>Number of enterprises</b>	<b>Average Annual staff</b>	<b>Total revenue (BGN million)</b>	<b>Revenue per worker (BGN thousand)</b>
<b>14</b>	<b>Manufacture Of Wearing Apparel</b>	<b>116</b>	<b>1,277</b>	<b>40.3</b>	<b>31.6</b>
<b>18</b>	<b>Printing &amp; Reproduction</b>	<b>31</b>	<b>276</b>	<b>20.1</b>	<b>73.0</b>
<b>32</b>	<b>Other Manufacturing</b>	<b>59</b>	<b>340</b>	<b>17.9</b>	<b>52.7</b>
<b>27</b>	<b>Manufacture Of Electrical Equipment</b>	<b>18</b>	<b>247</b>	<b>12.1</b>	<b>49.0</b>
2712	<i>Manufacture of electricity control and distribution apparatus</i>	5	110	7.1	64.5
2751	<i>Manufacture of domestic electrical appliances</i>	3	98	2.5	26.0
2740	<i>Manufacture of lamps and luminaires</i>	6	23	1.6	70.7
	<i>Other</i>	4	16	0.8	52.1
<b>15</b>	<b>Manufacture Of Leather &amp; Related Products</b>	<b>4</b>	<b>15</b>	<b>0.3</b>	<b>21.6</b>
<b>30</b>	<b>Manufacture Of Other Transport Equipment</b>	<b>2</b>	<b>2</b>	<b>0.0</b>	<b>10.0</b>
<b>33</b>	<b>Repair &amp; Installation Of Machinery &amp; Equipment</b>	<b>149</b>	<b>948</b>	<b>52.2</b>	<b>55.0</b>
3312	<i>Repair of general and special purpose machinery and equipment</i>	83	652	34.2	52.4
	<i>Other</i>	66	296	18.0	60.8
	<b>TOTAL (of above)</b>	<b>1,324</b>	<b>32,715</b>	<b>3,435</b>	<b>105.0</b>



**TABLE 5: COMPOSITION ICT AND OTHER MECHATRONIC-RELATED SECTORS IN STARA ZAGORA REGION IN 2021**

		Number of enterprises	Average Annual staff	Total revenue (BGN million)	Revenue per worker (BGN thousand)
<b>62</b>	<b>Computer Programming, Consultancy And Related Activities</b>	<b>170</b>	<b>556</b>	<b>40.8</b>	<b>73.5</b>
6201	<i>Computer programming</i>	50	292	16.4	56.2
6209	<i>Other information technology activities</i>	78	167	14.3	85.7
6202	<i>Information Technology Consultancy</i>	25	57	8.6	151.6
6203	<i>Management and servicing of computer tools and systems</i>	17	40	1.5	37.5
<b>63</b>	<b>Information Service Activities</b>	<b>47</b>	<b>116</b>	<b>5.1</b>	<b>43.7</b>
6399	<i>Other information services n.e.c.</i>	24	53	2.5	47.2
6311	<i>Data processing, hosting and similar activities</i>	16	46	2.0	42.7
6312	<i>Web portals</i>	7	17	0.6	35.6
	<b>Other related activities</b>				
7112	<i>Engineering activities and technical consulting</i>	159	357	27.9	78.1
7120	<i>Technical testing and analysis</i>	27	113	6.3	55.6
7219	<i>Research and development in the natural, medical, agricultural and technical sciences, excluding biotechnology</i>	7	122	9.1	74.7

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## Initiative for coal regions in transition

The Initiative for coal regions in transition is led by the European Commission.

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