

Competition

This report begins by first analysing Konux's direct competitors to try and get an understanding of the "playing field". Thus, to determine if companies were direct competitors or not, three criteria [1] were used, namely:

- Product Market: Sensors, Graphical User Interface, Analytics, Predictive Analytics
- Client Market: Passenger and freight rail operators
- Geographic Market: Germany

These three markets are being served by Konux. Thus, any other company serving the same three markets would be deemed as direct competitors. In the product market criteria, the terms Sensors, Graphical User Interface, ...etc, as listed above indicate the type of features that Konux's product or services can be grouped into. On the other hand, the client market indicates Konux's own client market while the last criteria, geographic market, is the market that was chosen to limit searches to. Thus, for example, a company serving passenger and freight rail operators operating outside Germany will not be considered as a direct competitor.

Methodology

1. Upon determining the criteria, a list of companies serving in the industrial IoT market in Germany was obtained from [2]
2. Then, the summary of each company was read.
3. The website of each company was visited in order to learn about the product and client market of the company.
4. The information from these sources were then tabulated (Appendix 1).

Findings

Table 1 summarises and refines the findings in Appendix 1 by tabulating the four direct competitors of Konux along with Konux to act as a reference. Terms in columns of Appendix 1 were refined by segregating them into the Product Market categories: Sensors, Graphical User Interface, Analytics, Predictive Analytics. The companies that did not have products / services that belonged to these four categories were excluded from Table 1. Readers shall note that item 4 in Table 1, i.e, Breuer Nachrichtentechnik GmbH was not obtained from Appendix 1. Instead, this company was discovered in [3]. It is also worth noting that the methodology employed in this section is based on qualitative analysis and is subjective. While Table 1 is useful to get a quick glance of the direct competitors of Konux, the broad nature of the Product Market category does little to visualize the heterogeneity of the features of the products and

Note: The terms "type" and "category" are used interchangeably

services offered by the companies. Thus, step 3 of the methodology was repeated, this time describing the product / service features under “Product Market” in greater detail. The findings are tabulated in Table 2.

As shown in Table 2, there are some product / service features under “Product Market” that are essentially similar in the sense that they tackle the same issue or solve the same problem. For example, item A in the legend below Figure 1 represents three features that were previously identified in Table 2. These features were categorised to be tackling the “track component monitoring” feature. In total, 15 feature categories each representing an individual feature from Table 2 were identified. These feature categories are represented by the bold alphabets in the legend below Figure 1. On the other hand, the numbering on the right in the legend and the numbers in Figure 1 are the individual features from Table 2 that make up each feature on its left.

Table 1: Konux and The Direct Competitors

No.	Competitor Names	Product Market	Client Market
1	KONUX	Sensors, Graphical User Interface, Analytics, Predictive Analytics	Passenger and Freight Rail Operators
2	Eltec Elektronik AG		
3	Senvisys		
4	Breuer Nachrichtentechnik GmbH		
5	Embever GmbH		

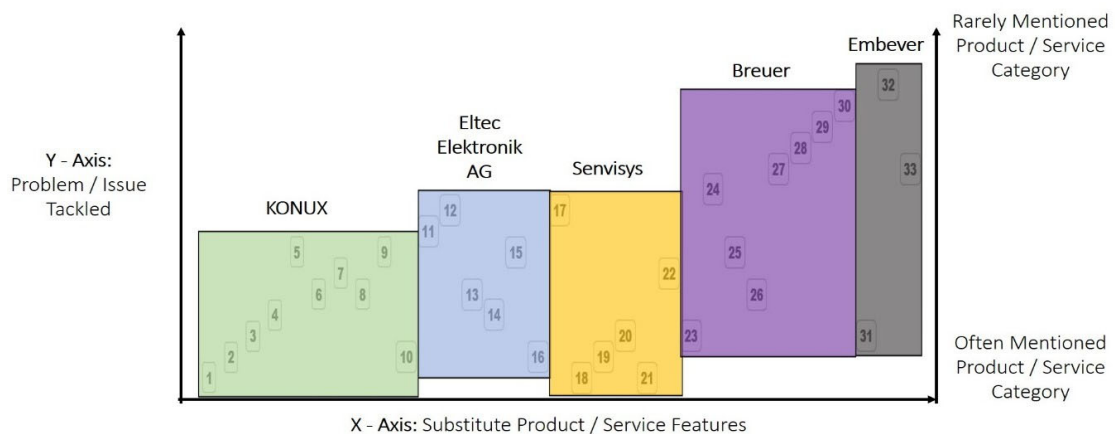
Table 2: Product / Service Features of Konux and its Competitors

No.	Competitor Names	Product Market
1	KONUX	<ol style="list-style-type: none"> 1. Switch components monitoring 2. Autonomous data collection 3. Sensors 4. Dashboard 5. Remote monitoring 6. Recommendations 7. Vibration data 8. 90-day forecasting 9. Cloud / SaaS 10. Continuous monitoring

Note: The terms “type” and “category” are used interchangeably

No.	Competitor Names	Product Market
2	Eltec Elektronik AG	11. Large amount of data exchange with ground 12. Fleet monitoring 13. Predictive Analytics / Recommendations 14. Dashboard 15. Remote monitoring 16. Autonomous data collection
3	Senvisys	17. Fleet monitoring 18. Track monitoring 19. Autonomous data collection 20. Sensor system 21. Location / Area monitoring 22. Vibration data
4	Breuer	23. Sensor system 24. Operations management 25. Remote monitoring 26. Predictive Analysis 27. Consulting 28. Client IT integration 29. Digital twin 30. Simulation technology
5	Embever GmbH	31. Sensor system 32. Prototyping and testing 33. Consulting

Figure 1: Visualization of Product / Service Features of the Companies



A	track component monitoring	1	18	21	
B	continuous autonomous monitoring	2	10	16	19
C	sensors system	3	20	23	31
D	dashboard / Graphical User Interface	4	14		
E	predictive analytics / action recommendations	6	8	13	26

Note: The terms “type” and “category” are used interchangeably

F	measure vibration data	7	22		
G	wireless / remote monitoring / cloud	5	9	15	25
H	large data exchange bandwidth / high speed network connection	11			
I	fleet / rolling stock monitoring	12	17		
J	Operations Management	24			
K	Consulting	27	33		
L	Integrate systems / software into clients' existing IT infrastructure	28			
M	Digital Twin	29			
N	Simulation Technology	30			
O	Prototyping & Testing	32			

Based on Figure 1, the first inference that can be drawn is that most of the companies offer a very heterogenous array of product or service features that are horizontally differentiated while only Embever offers the least spread of heterogenous features. However, Embever has the most vertically differentiated features, followed closely by Breuer. Thus, it may be further inferred that Konux, Eltek Elektronik and Senvisys are (or would be, if expanding into markets outside of Germany) targeting a broader range of clients while Embever and Breuer target a more niche client base.

Clients

In this section, Konux's existing clients are studied. The purpose of doing this is to determine if any of Konux's clients pose bargaining powers. Bargaining power for a client exists when a big portion of a company's revenue is contributed by that client. It is worth noting that readers can easily substitute assumptive figures / variables with actual data when available. Thus, the inferences in this section can be used as a framework.

Methodology

1. To obtain the revenue figures, its portions and sources of contribution, the [2] and [3] sources were accessed. However, revenue figures were not found. Thus, steps 2 and 3 below were implemented.
2. To make an assumption of the size of portions of revenue contributed by each client, the clients were broken into three categories by type of revenue, denoted by X, Y and Z as shown below:
 - X: Revenue from passenger and freight rail operators in Germany

Note: The terms “type” and “category” are used interchangeably

- Y: Revenue from pilot projects in Europe (outside of Germany) awarded to Konux
 - Z: Revenue from undisclosed name of companies / projects
3. If there were multiple clients in a category, they were assumed to contribute equally. The client names and the estimated portions of revenue contributed are tabulated in Table 3.

Findings

Konux's clients consist of Deutsche Bahn (DB), Société nationale des chemins de fer français (SNCF), Ferrocarrils de la Generalitat de Catalunya (FGC), Infrabel, Swedish Transport Administration (Trafikverket) and a Japanese company whose name was not disclosed in [2] and [3]. The exact values of the revenue contributed by each client is not known.

Hence, the portions of contribution by each client were estimated and can be approximated to 1 as shown in Table 3. Additionally, based on the scope of this project of taking into account only companies operating within Germany, DB would contribute to 100 % of Konux's revenues in Germany. Thus, DB would have the bargaining power. Strategically, this would make Konux's position more vulnerable in terms of revenue dependency. Thus, to safeguard Konux's position, the Lock-In and High-Switching Cost strategies (both discussed in later sections) can be utilized.

Table 3: Konux's Clients and the Portion of Contribution to Konux's Total Revenue [2, 3]

No.	Client	Portion of Total Revenue
1	Deutsche Barn	X
2	SNCF Réseau	0.3Y
3	FGC	0.3Y
4	Infrabel	0.3Y
5	Swedish Transport Administration (Trafikverket)	0.5Z
6	Japanese company (client name unknown)	0.5Z
Total Revenue		$I \approx X + [3(0.3)Y] + [2(0.5)Z]$

Note: The terms “type” and “category” are used interchangeably

References

- [1] Tobias Kretschmer, PhD, "Coursera," in *Competitive Strategy*, Institute for Strategy, Technology and Organization.
- [2] M. H. K. GmbH, "Predictive Maintenance for railway switches. Smart sensor networks on a machine learning analytics platform," CORDIS, EU research results, 2018.
- [3] M. University, "MMU Engineering ITP System," 1 June 2015. [Online]. Available: <http://fet.mmu.edu.my/itp>.
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- [5] Konux, "Blog," 2020. [Online]. Available: <https://www.konux.com/konux-wins-deutsche-bahn-tender/>. [Accessed 2021].

Appendix 1

Appendix 1: List of Industrial IoT Product / Service Providers in Germany and the Client Industries they serve. This list does not include IoT network (such as LoRaWan) operators. Note: The terms used in the “Product / Service Categories” and “Clients' Industry Categories” columns in this table are not yet refined. Thus, different terms could imply the same meaning

No.	Name	Product / Service Categories	Clients' Industry Categories
1	ProGlove	Wearables, Gloves	Manufacturing, Aerospace, Automotive, Retail
2	PTV Planung Transport Verkehr AG	Software, Consulting	Logistics & Transportation
3	AXOOM (TRUMPF)	IT services	Manufacturing
4	CONTACT Software GmbH	Software, Analytics, Predictive Analytics	Manufacturing
5	Fraunhofer IOSB	Vision Systems, Image Analysis	National Security & Defense
6	Global Navigation Systems	Embedded Products	OEM / Embedded Systems
7	iTAC Software AG (Durr)	Manufacturing Execution Systems, IT, software	Manufacturing
8	Kentix	Security Systems	Various
9	Konux	Sensors, Analytics, Predictive Analytics	Railway & Metro
10	KUKA AG	Robots/Automation, Programmable Logic Controllers (PLCs)	Manufacturing
11	ME-Automation Projects (Mitsubishi Electric)	PLCs	Various
12	PHYTEC	Embedded Products . System on Modules (SoM)	OEM / Embedded Systems
13	PROCAD	Product Lifecycle Management (PLM), Project Data Management (PDM), Project Document Management (PDM)	Manufacturing, Automotive, Aerospace, Maritime
14	Rexroth (Bosch)	Non-IoT	Manufacturing
15	Rittal	KIV	Manufacturing

Note: The terms “type” and “category” are used interchangeably

No.	Name	Product / Service Categories	Clients' Industry Categories
16	SLM Solutions Group AG	3D Metal Printers	Manufacturing
17	YASKAWA VIPA Controls	PLCs	Manufacturing
18	ADaptive Manufacturing Open Solutions (ADAMOS)	Platform, Software, Analytics, Predictive Analytics	Manufacturing
19	ads-tec GmbH	IT hardware, IT software, Embedded systems	Manufacturing
20	ADUK GmbH	Embedded products, Sensors, Software / Systems on Modules (SOM), Predictive Analytics	Various
21	Apostera	Software, Driver Assistance	Automotive
22	ArtiMinds Robotics GmbH	Software / Platform, Analytics	Manufacturing
23	Avenga	SaaS / PaaS, Consulting	Various
24	Axiros	Consulting / Management	Telecommunications
25	AXOOM	Consulting / Management	Manufacturing
26	azeti Networks AG	Paas, Analytics, PLC	Various
27	Balluff	Sensors	Various
28	Basler AG	Cameras, OEM, SOM, Vision Technology	Various
29	Baumüller	Robots/Automation, PLCs, Consulting, PaaS, Predictive Analytics	Various
30	Bosch IoT Suite (Bosch)	Paas, Analytics	Various
31	WIBU-SYSTEMS	Software, Cybersecurity	Various
32	SAP	SaaS / PaaS, Predictive Analytics	Various

Note: The terms “type” and “category” are used interchangeably

No.	Name	Product / Service Categories	Clients' Industry Categories
33	Siemens	Manufacturing, Consulting, Automation, Predictive Analytics, Cybersecurity	Various
34	Werma	Signaling systems	Manufacturing, Logistics
35	Auvesy	Software, Data Management	Various
36	Infineon	Semiconductors, Sensors	Various
37	Osram Semiconductors	Lighting, Light Sensors	Various
38	PHOENIX CONTACT	Platform, Analytics, Sensors, PLCs	Various
39	SKS Kontakttechnik	Physical Product Development	Manufacturing
40	See itwm 14, above: Bosch.IO (Bosch)		
41	Implico	Consulting / Management, SaaS, Platform / PaaS, Logistics, Predictive Analytics	Oil & Gas
42	S+P Samson	Identification Labels / Tags	Various
43	Beckhoff	Instrumentation & Control Systems	Various
44	relayr	Predictive Analytics, Consulting, Sensors	Various
45	Software AG	Software / SaaS, Platform / PaaS, Predictive Analytics, IT systems	Various
46	BeanAir	Sensors, Analytics	Various
47	See itwm 14 & 40, above: Bosch		

Note: The terms “type” and “category” are used interchangeably

No.	Name	Product / Service Categories	Clients' Industry Categories
48	EPLAN	Software / SaaS, Platform / PaaS	Various
49	Kontron	Embedded Products, Software / SaaS, Platform / PaaS, SOM	Various
50	Aicas	Software, SOM	Various
51	Cybus	Software, SaaS / PaaS, SOM	Manufacturing, Logistics
52	FORCAM	Software, SaaS / PaaS, Analytics, Consulting, IT Systems	Manufacturing
53	congatec AG	Embedded Products, SOM	Various
54	Hirschmann (Belden)	Networking Systems, Sensors, Instrumentation & Control Systems	Various
55	abas	Software, SaaS / PaaS, ERP	Manufacturing
56	Leica Geosystems (Hexagon)	UAVs, Geo-Mapping / Surveying	
57	Leuze electronic	Sensors, Embedded Vision, Labels / Tags	Manufacturing
58	NavVis	Office / Shop Floor Mapping	Manufacturing
59	Bosch IoT Suite (Bosch)	Software	Various
60	BuildingMinds	Revolutionizing building management.	Real Estate
61	CCC Software	-	-
62	Codesys	automation software	Renewable Energy
63	Cognigy	AI platform for Customer Service Automation	E-Commerce
64	Connectavo	-	-
65	DATA MODUL	Display	Various
66	Derdack	Alert Notifications	Various
67	Deutsche Telekom	-	-

Note: The terms “type” and “category” are used interchangeably

No.	Name	Product / Service Categories	Clients' Industry Categories
68	DIGIMONDO	-	-
69	drag&bot	Robots, Automation	Manufacturing, Packaging
70	Durr	Consulting, Shop-Set-Up	Various
71	Eltec Elektronik AG	WIRELESS COMMUNICATION, Analytics, Predictive Analytics, Sensors	Railway & Metro, Automotive
72	Embever GmbH	IoT hardware & firmware prototyping	Railway, Environment
73	Emnify	SaaS, Devices / Machines network connectivity, Analytics	Various
74	ENISCO	Manufacturing execution system (MES), Consulting	Manufacturing
75	EnOcean	Energy, switches, sensors, actuators / gateways	Various
76	Extheria GmbH	Sensors, analytics	Manufacturing, Logistics
77	Flexis	ERP, Software	Manufacturing, Logistics
78	Fliit	ERP, Software	Food & Beverage, Logistics
79	fos4X	Sensors, analytics, wind turbine development & manufacturing	Energy
80	GOPEL electronic	-	-
81	HARTING Technology Group	Electrical / Network / Mechanical connections, sensors, analytics, predictive analytics	Railway, Various
82	Hilscher System Automation	Sensors, Networking, Software, SaaS, PaaS, GUI, Analytics, Predictive Analytics, SoC, OEM	Manufacturing
83	HiveMQ	Networking, Data storage	Automotive, Logistics, Manufacturing
84	Holo-Light	Virtual Reality, Augmented Reality, CAD in AR, Cloud storage	Various
85	Hyperstone	NAND Flash Memory Controllers	Various
86	IBHsoftec	Software. PLC, Hardware	Various
87	idatase (Netlume)	Analytics, Predictive Analytics	Various
88	ifm efector	Sensors, Software, Tags, Analytics	Various
89	Indu-Sol	Networking	Various

Note: The terms “type” and “category” are used interchangeably

No.	Name	Product / Service Categories	Clients' Industry Categories
90	Edge Analytics (Industrial Analytics Berlin IAB)	Sensors, Analytics, Predictive Analytics	Various
91	InoNet Computer	IT systems	Various
92	Inspirient	Software, Analytics, Predictive Analytics, Accounting	Sales, Manufacturing, Logistics
93	INSYS icom	Networking, Industrial Internet Routers, Software	Various
94	INTRANAV	Sensors, Analytics, Predictive Analytics	Logistics, Manufacturing, People / Safety Management
95	IOTA	Sensors, Analytics, Predictive Analytics	Logistics, Manufacturing, People / Safety Management, Smart Cities
96	IS Predict	Sensors, Analytics, Predictive Analytics	Various
97	KEB	Software, Hardware, Electrical equipment, Analytics, Predictive Analytics	Automotive, Energy
98	Keith & Koep GmbH	SOM, Touchpanel Computers, hardware, software, baseboards (motherboards)	Various
99	Kubermatic	Kubernetes and cloud native operations	Various
100	Kübler Group	Hardware, Sensors, Transmission technologies	Various
101	Lapp Group	Electrical Cabling / Wiring,	Railway, Logistics, Manufacturing
102	Logicline	IOT solutions vendor, Consulting, Software	Various
103	LTi Motion (Keba)	Sensors, Motors, GUI, Analytics, Touchpd/ Input devices	Manufacturing, Energy
104	M&M Software	Software, Consulting, Analytics, Predictive Analytics	Manufacturing, Energy, Agriculture
105	MatchX	wireless LoRaWAN networking solutions, sensors, analytics	General Consumer (Public)
106	Maxion	wheels manufacturing, Analytics, tags	Automotive
107	MING Labs	Web programming, user research / analytics, software	Various

Note: The terms “type” and “category” are used interchangeably

No.	Name	Product / Service Categories	Clients' Industry Categories
108	MotionMiners	Sensors, Analytics, Motion Capture, Staff Management	Logistics, Manufacturing, Health Care
109	Movilitas Consulting	Vendor for SAP, Analytics, Software, Consulting	Various
110	MPDV	Manufacturing Execution Systems, IT, software	Various
111	MSC Technologies	Motherboards, Tablets, displays, signaling systems, GUI, Embedded PCs, Analytics	Railway, Manufacturing, Various
112	Nanotron (Inpixon)	Sensors, Analytics, Tags, GUI	Manufacturing, Mining, Healthcare, Livestock
113	Ince	IoT network / carrier, Sim Cards, Analytics, Tracking	Waste management, Logistics
114	Oncite	Software, IT, Analytics, Cloud	Manufacturing
115	OpenSynergy	Systems on Chips (SOCs), Android Automotive OS	Automotive
116	Pepperl+Fuchs	Sensors, Embedded Vision, Software, Electrical Explosion Protection Technology	Various
117	PerfectPattern GmbH (Ludwig Maximilians University Spin Off)	Artificial Intelligence, MRP / ERP / Production Planning, Analytics, Predictive Analytics, Software, GUI, PaaS, SaaS	Various
118	piezosystem jena	piezoelectric technology, piezoelectric components	Various
119	ProLeiT	software, MES, PLC control systems, ERP, Production Data Acquisition (PDA) Systems	Manufacturing
120	PROSTEP	software, consulting, product lifecycle management	Manufacturing
121	RAFI	buttons, switches, control systems, machinery, machine operating systems, automation software	Manufacturing
122	Real-Time Systems	Real-Time Operating System, hardware-software integration	Various
123	Re-flekt	AR, procedure visualization	Various
124	robodev GmbH	automation software, platform, software, hardware, modules	Various

Note: The terms “type” and “category” are used interchangeably

No.	Name	Product / Service Categories	Clients' Industry Categories
125	Robotics Technology Leaders GmbH	Hardware, Software, PLCs, modules, automation	Broadcasting
126	ROSCH	Computer components, hardware, embedded devices, displays, modules	Railway, Various
127	SALT Software	IT systems, Consulting, Analytics, SAP-Systems	Logistics, Manufacturing
128	SCHMID Technology Systems	Solar PV, Electronics, Automation, Software, Analytics, Predictive Analytics, Simulation, Platform	Energy Storage
129	Senvisys	Vibration Sensors, Analytics, Predictive Analytics	Railway
130	Sevskiy	Antenna, Radio Frequency, Consulting	Various
131	shipcloud.io	Software, E-Commerce, ERP, Carriers' Vendor	Logistics
132	SICK	Sensors, Analytics	Manufacturing, Energy, Logistics
133	Siemens Advanta	Consulting, Designing / Prototyping, Shop-Set-Up	Various
134	Signal Cruncher	Analytics, Predictive Analytics	Building / Real Estate, Energy, Manufacturing
135	Simplifier	Platform, Analytics, Software	Manufacturing, Energy
136	Softing	Data connectivity / flow monitoring, Data flow / connectivity enhancing, Networking, IT systems	Manufacturing, Automotive, IT Networks
137	Sycor	consulting, ERP, Software, MES, Analytics, Predictive Analytics, Microsoft & SAP vendor	Automotive, Manufacturing
138	Synapticon	Hardware, Software, Automation, OEM, Sensors, Analytics, Predictive Analytics	Various
139	Synfioo GmbH	transportation, ERSupply chain management, software, analytics, predictive analytics	Various
140	SYSTEMA GmbH	Art of Automation	Various
141	Tacterion	Sensors, Analytics	Various
142	TeamViewer	Software, Analytics, Platform, API	Various

Note: The terms “type” and “category” are used interchangeably

No.	Name	Product / Service Categories	Clients' Industry Categories
143	Telic AG	Consulting, Hardware, Sensors, Connectivity, Prototyping, Software, Platform, Full-Suite, Set-Up Shop	Manufacturing
144	Teraki	AI platform for Automation of vehicles	Automotive
145	ThreeB IT	Software, Platform, Management Software, SaaS	Various
146	Thyssenkrupp	NOT IoT...Typical MANUFACTURER	(Engineering Support Industry) ESI
147	TQ-Systems	Energy Management, ERP, Analytics	Various
148	Trumpf	Hardware, Software, Manufacturer, Automated Machines, Smartg Machines, ERP, Platform	Various
149	T-Systems (Deutsche Telekom)	Sensors, Analytics, Predictive Analytics	Various
150	Turck	Sensors, Identification hardware, GUI	Various
151	Ubimax	AR, procedure visualization	Manufacturing, Packaging, Inspection, Sales
152	UNITY Consulting	Consulting	Various
153	Volocopter	Not IoT...Electric Air Taxi	Not IoT...Electric Air Taxi
154	Wandelbots	Wearables, Automation, Robotics, Hardware, Software, Platform, Machine Learning	Manufacturing, Automotive

Note: The terms “type” and “category” are used interchangeably