Berner Fachhochschule
Haute école spécialisée bernoise
Bern University of Applied Sciences

2024
Abschlussarbeiten
Travaux de fin d'études
Graduation Theses

BSc in Wirtschaftsingenieurwesen
BSc en Ingénierie de gestion
BSc in Industrial Engineering and Management Science

- Technik und Informatik
- Technique et informatique
- Engineering and Computer Science

Inhalt
Table des matières
Contents

Impressum
Berner Fachhochschule
Technik und Informatik
kommunikation.ahb-ti@bfh.ch

Online
bfh.ch/ti/book

Inserate
bfh.ch/ti/book

Layout
Hot's Design Communication SA

Druck
staempfli.com

Impressum
Haute école spécialisée bernoise
Technique et informatique
communication.ahb-ti@bfh.ch

Online
bfh.ch/ti/book-fr

Annonces
bfh.ch/ti/book-fr

Mise en page
Hot's Design Communication SA

Impression
staempfli.com

Imprint
Bern University of Applied Sciences
Engineering and Information Technology
communication.ahb-ti@bfh.ch

Online
bfh.ch/ti/book-en

Advertisements
bfh.ch/ti/book-en

Layout
Hot's Design Communication SA

Printing
staempfli.com

Editorial
Éditorial
Editorial

Prof. Dr. Stefan Grösser
Leiter Wirtschaftsingenieurwesen
Responsable du domaine Ingénierie de gestion
Head of Industrial Engineering and Management Science

Liebe Leserin, lieber Leser

In einer Welt, die zunehmend von Technologie und künstlicher Intelligenz (KI) geprägt wird, kommt Wirtschaftsingenieur*innen eine entscheidende Rolle zu. Sie agieren als Brückenbauende zwischen den Bereichen der Technik, Informatik und Wirtschaft und verfügen über das erforderliche Wissen, um innovative Lösungen an der Schnittstelle dieser Disziplinen zu entwickeln. Ihre Fähigkeit, unterschiedliche Perspektiven zu integrieren und die Zusammenarbeit zwischen verschiedenen Abteilungen optimal zu gestalten, macht Unternehmen zukunftsfähig.

Im Studium werden Studierende nicht nur in klassischen Feldern wie Betriebswirtschaftslehre und Technik ausgebildet, sondern erhalten auch fundierte Einblicke in die Welt der künstlichen Intelligenz. Sie lernen, wie KI-Systeme funktionieren, wie sie entwickelt und eingesetzt werden können. Diese Kompetenz ist äusserst wertvoll, denn KI ist ein Schlüsselfaktor für Innovation und Effizienz.

Das Studium ist anspruchsvoll und zukunftsgerichtet – praxisnah, zielorientiert und eng mit den aktuellen Anforderungen und Chancen der Arbeitswelt verknüpft. Studierende erwerben spezifische Fähigkeiten, die ihnen heute und zukünftig entscheidende Vorteile im Berufsleben verschaffen.

Unsere Absolvent*innen repräsentieren die nächste Generation von Führungskräften, die mit ihrer Arbeit signifikante Veränderungen bewirken werden.

Ich sehe mit grosser Vorfreude, wie sie ihr Potenzial entfalten und sich den Herausforderungen der Zukunft stellen.

Chère lectrice, cher lecteur,

Dans un monde de plus en plus empreint de technologie et d'intelligence artificielle (IA), les ingénieur-e-s de gestion jouent un rôle crucial. Ils et elles bâtissent des ponts entre les domaines de la technique, de l'informatique et de l'économie et disposent du savoir nécessaire pour développer des solutions innovantes à l'interface de ces disciplines. Leur capacité à intégrer différentes perspectives et à organiser de manière optimale la collaboration entre les différents services prépare les entreprises à répondre aux exigences futures.

Au cours de leur cursus, nos étudiant-e-s ne sont pas uniquement formé-e-s dans des domaines classiques tels que la gestion d'entreprise et la technique, mais également sensibilisé-e-s au monde de l'intelligence artificielle. Ils et elles se familiarisent avec le fonctionnement des systèmes d'IA, et apprennent comment ils sont développés et utilisés. Il s'agit là d'une compétence extrêmement précieuse, car l'IA est un facteur clé d'innovation et d'efficacité.

Les études sont exigeantes. Ciblées, axées sur la pratique et étroitement liées aux exigences et opportunités actuelles du monde du travail, elles sont également ouvertes sur l'avenir. Les étudiant-e-s acquièrent des compétences spécifiques qui leur donnent une longueur d'avance dans la vie professionnelle, aujourd'hui comme demain.

Nos diplômé-e-s sont la prochaine génération de leaders ; par leurs accomplissements, ils et elles seront à l'origine de changements significatifs.

Les voir réaliser leur potentiel et relever les défis futurs me remplit de joie.

Dear Reader

In a world increasingly shaped by technology and artificial intelligence, industrial engineers have a crucial role to play. They act as bridge builders between technology, IT and business, and their expertise is key to developing innovative solutions at the interface between those disciplines. Their ability to integrate different perspectives and optimise collaboration between different departments makes companies fit for the future.

In our bachelor's degree programme, students are not only trained in traditional fields such as business administration and technology, but also gain in-depth insights into the world of artificial intelligence. They learn how AI systems work, and how to develop and use them. Such expertise is extremely valuable, as AI is key to enabling innovation and efficiency.

Our programme is demanding, future-oriented, industry-relevant, goal-driven, and aligned with the current requirements and opportunities of the working world. Students acquire specific skills that will give them a decisive advantage in their professional lives – today and in the future.

Our graduates represent the next generation of leaders. Their work will bring about significant changes.

I look forward with great anticipation to seeing how they develop their potential and face the challenges of the future.

Wirtschaftsingenieurwesen an der BFH
L'ingénierie de gestion à la BFH
Industrial Engineering and Management Science at BFH

Die Berner Fachhochschule BFH steht für eine dynamische und zukunftsorientierte Ausbildung, in der praxisnahe Erfahrungen und innovative Lösungen im Mittelpunkt stehen. Im Departement Technik und Informatik werden Studierende des Wirtschaftsingenieurwesens nicht nur mit aktuellem Fachwissen ausgestattet, sondern auch dazu inspiriert, als Pionier*innen ihrer Branche voranzugehen. Dieser Studiengang bietet eine interdisziplinäre und internationale Lernerfahrung, die eng mit der Industrie verknüpft ist und somit einen direkten Weg in eine erfolgreiche Karriere ebnet.

Im Bachelor-Studiengang Wirtschaftsingenieurwesen werden die Studierenden optimal auf die Herausforderungen und Chancen einer digitalisierten Berufswelt vorbereitet. Durch eine Mischung aus technischer Expertise und wirtschaftlichem Verständnis entwickeln sie die Fähigkeit, innovative Ideen in erfolgreiche Unternehmungen umzusetzen. Der zweisprachige Ansatz des Studiums garantiert zudem exzellente Englischkenntnisse, was die Absolventinnen und Absolventen für den internationalen Markt attraktiv macht.

Studieninhalt
Die Lehrinhalte, strukturiert in drei modernen Vertiefungsrichtungen, adressieren essenzielle Themen wie Digitalisierung, Industrie 4.0 und Prozessoptimierung. Ergänzend bietet die Option eines Minors die Möglichkeit zur Spezialisierung in gefragten Bereichen wie Nachhaltigkeit, Entrepreneurship oder Künstliche Intelligenz. Durch diesen interdisziplinären und praxisnahen Ansatz sind die Studierenden in der Lage, innovative Lösungen für komplexe Herausforderungen zu entwickeln und anzuführen.

Zukunftsaussichten
Nach dem Studium können Absolvent*innen in verschiedenen Funktionen und Unternehmensbereichen tätig sein: Produktion und Logistik, Produktentwicklung, Einkauf, Vertrieb, Management und Organisation, IT- sowie Datenmanagement. Mit der Entwicklung künstlicher Intelligenz oder erweiterter Anwendungsformen der Blockchain-Technologie entstehen bereits jetzt spannende Berufsfelder, welche den Absolvent*innen des Bachelors of Science in Wirtschaftsingenieurwesen weitere Perspektiven eröffnen. Die bekannten und neuen Berufsbilder in kleinen,

La Haute école spécialisée bernoise BFH se distingue par des formations dynamiques et tournées vers l'avenir, qui s'articulent autour des expériences pratiques et du développement de solutions innovantes. En plus de doter les étudiant-e-s de connaissances techniques actuelles, le cursus d'ingénierie de gestion du département Technique et informatique inspire les futur-e-s spécialistes à devenir des pionniers et pionnières de leur secteur d'activité. Il livre une expérience d'apprentissage interdisciplinaire et internationale, étroitement liée à l'industrie, offrant une base solide sur laquelle asseoir une carrière prometteuse.

La filière de Bachelor en Ingénierie de gestion prépare les étudiant-e-s de manière optimale aux défis et aux opportunités d'un monde du travail numérique. Grâce à un mélange harmonieux d'expertise technique et de compréhension économique, ils et elles développent la capacité de transformer des idées innovantes en entreprises performantes. L'approche bilingue des études garantit en outre d'excellentes connaissances en anglais, ce qui ouvre aux diplômé-e-s la porte du marché international.

Contenu de la formation
Structurés selon trois orientations modernes, les cours abordent des thèmes essentiels tels que la numérisation, l'industrie 4.0 et l'optimisation des processus. Le minor proposé en complément permet en outre de se spécialiser dans des domaines très dynamiques tels que développement durable, l'entrepreneuriat ou l'intelligence artificielle. Cette approche interdisciplinaire et pratique rend les étudiant-e-s aptes à concevoir et mettre en œuvre des solutions innovantes pour des défis complexes.

Perspectives professionnelles
Ce cursus qualifie les diplômé-e-s pour divers postes et secteurs d'activité de l'entreprise : production et logistique, développement de produits, achat, vente, gestion et organisation, gestion informatique, gestion des données et gestion de la qualité. Le développement de l'intelligence artificielle ou de formes étendues d'application de la chaine de blocs (blockchain) lève le voile aujourd'hui déjà sur des domaines professionnels prenants, qui ouvrent des perspectives supplémentaires

Bern University of Applied Sciences BFH stands for a dynamic, future-oriented education with a strong emphasis on practical experience and innovative solutions. In the School of Engineering and Computer Science, industrial engineering and management science students are not only furnished with cutting-edge technical knowledge, but also inspired to lead the way as pioneers in their sector. This degree programme offers an interdisciplinary, international learning experience with close links to industry, thus paving the way for a successful career.

On the bachelor's degree programme in Industrial Engineering and Management Science, students are ideally equipped for the challenges and opportunities of a digitalised professional environment. Through a mix of technical expertise and commercial insight, they develop the ability to turn innovative ideas into successful ventures. The bilingual approach of the programme also guarantees excellent English language skills, which makes the graduates attractive to the international market.

Programme content
The course content is structured in three modern specialisations and deals with essential topics such as digitalisation, Industry 4.0 and process optimisation. With the additional option of a minor, students have the opportunity to specialise in fields that are currently in high demand, such as sustainability, entrepreneurship and artificial intelligence. This interdisciplinary, practice-driven approach enables students to develop and implement innovative solutions to complex challenges.

Career prospects
Students find employment opportunities in a wide range of roles and company divisions after graduation: production and logistics, product development, purchasing, sales, management and organisation, IT, data and quality management. The development of artificial intelligence and wider forms of application for blockchain technology are creating exciting new areas of employment, opening up further career opportunities for holders of a Bachelor of Science in Industrial Engineering and Management Science. Present and new job profiles in small, medium and large organisations are business analyst, process manager,

mittleren und grossen Organisationen sind Business Analyst*in, Prozessmanager*in, Produktionsmanager*in, Projektmanager*in, Produktmanager*in, Data Analyst*in und Supply Chain Manager*in. Dank der Zweisprachigkeit des Studiengangs erlangen sie hervorragende Englischkenntnisse und werden so fit für den globalen Arbeitsmarkt.

Für diejenigen, die ihre Fachkenntnisse vertiefen möchten, bietet die BFH zudem anspruchsvolle Master-Programme an. Die Kombination aus hochwertiger Lehre, anwendungsorientierter Forschung und enger Industrieanbindung macht ein Studium am Departement Technik und Informatik an der BFH zu einer hervorragenden Wahl für angehende Wirtschaftsingenieur*innen, die an der Spitze des Fortschritts stehen wollen.

Erfahren Sie mehr über

- den Fachbereich Wirtschaftsingenieurwesen: bfh.ch/wirtschaftsingenieurwesen
- das Departement Technik und Informatik: bfh.ch/ti
- Forschung an der BFH: bfh.ch/forschung
- Weiterbildungsangebote am Departement Technik und Informatik: bfh.ch/ti/weiterbildung
- ein Bachelor-Studium: bfh.ch/ti/bachelor
- ein Master-Studium: bfh.ch/ti/master
- die Zusammenarbeit mit der Industrie: bfh.ch/ti/projektidee
- entrepreneurship an der BFH-TI: bfh.ch/ti/entrepreneurship

aux titulaires du Bachelor of Science en Ingénierie de gestion. Les profils professionnels actuels et les nouveaux métiers dans les petites, moyennes et grandes organisations sont nombreux : analyste commercial, gestionnaire de processus, gestionnaire de production, gestionnaire de projet, gestionnaire de produit, analyste de données et gestionnaire de chaine d'approvisionnement. La nature bilingue de la formation permet aux étudiant-e-s d'acquérir un excellent niveau d'anglais et d'étendre leurs perspectives professionnelles au marché mondial du travail.

La BFH propose également des programmes de master exigeants qui s'adressent à ceux et celles qui souhaitent approfondir leurs connaissances. En associant enseignement de qualité, recherche appliquée et étroite coopération avec l'industrie au sein d'une même formation, le département Technique et informatique de la BFH promet des études de premier ordre pour les futur-e-s ingénieur-e-s de gestion qui souhaitent s'installer à la pointe du progrès.

En savoir plus sur

- le domaine Ingénierie de gestion : bfh.ch/ingenieriedegestion
- le département Technique et informatique : bfh.ch/ti
- la recherche à la BFH : bfh.ch/recherche
- l'offre de formation continue du département Technique et informatique : bfh.ch/ti/formationcontinue
- les études de bachelor : bfh.ch/ti/fr/bachelor
- les études de master : bfh.ch/ti/fr/master
- la collaboration avec l'industrie : bfh.ch/ti/idee-projet
- l'entrepreneuriat à la BFH-TI : bfh.ch/ti/entrepreneurship

production manager, project manager, product manager, data analyst and supply chain manager. Thanks to the programme's bilingual approach, the students gain an outstanding knowledge of English, which in turn means that they are well equipped for the global labour market.

For those who wish to pursue a greater depth of technical knowledge, BFH also offers challenging Master's programmes. The combination of quality teaching, application-oriented research and close links to industry makes studying at the BFH School of Engineering and Computer Science an excellent choice for prospective industrial engineers who are keen to be at the forefront of progress.

Learn more about

- the Industrial Engineering and Management Science Division: bfh.ch/industrial-engineering
- the School of Engineering and Computer Science: bfh.ch/ti
- research at BFH: bfh.ch/research
- continuing education courses at the School of Engineering and Computer Science: bfh.ch/ti/continuingeducation
- Bachelor studies: bfh.ch/ti/en/bachelor
- Master studies: bfh.ch/ti/en/master
- cooperation with industry: bfh.ch/ti/projectidea
- entrepreneurship at BFH-TI: bfh.ch/ti/entrepreneurship

Steckbrief
Fiche signalétique
Fact Sheet

Titel/Abschluss
Bachelor of Science (BSc)

Studienform
Vollzeitstudium (6 Semester) oder berufsbegleitendes Teilzeitstudium (8 Semester oder individueller Studienplan) sowie praxisintegriertes Bachelor-Studium für Inhaber*innen einer gymnasialen Maturität (8 Semester)

Unterrichtssprache
Zweisprachig Deutsch/Englisch. Je die Hälfte des Studiums wird auf Deutsch oder Englisch unterrichtet.

Majors (Vertiefungen)
Die Studierenden wählen im letzten Drittel ihres Studiums eine Vertiefung und setzen damit Akzente für die berufliche Karriere:
- Digitalisierung – Business Engineering
  Gestaltung von Management- und Innovationsprozessen für konventionelle und digitale Unternehmen, Geschäftsprozessmanagement, Datenanalyse und Visualisierung, Produkt- und Servicedesign sowie Innovationsmethoden.
- Industrie 4.0 – Industrial Engineering
  Produktionssysteme und Management, Operations Research, Simulation betrieblicher Prozesse sowie Ressourcenplanungssysteme der Produktion.
- Supply Chain und Process Engineering
  Wertschöpfungsnetzwerke, die Rolle, die ein Unternehmen in solchen Netzwerken einnimmt, unternehmensinterne und -externe Prozesse, Advanced Process Analysis and Automation, Circular Supply Chains sowie Technologien und Informationssysteme in der Logistik.

Minors (Schwerpunkte)
- Energie und Nachhaltigkeit
- Entrepreneurship
- weitere

Abschlussarbeit
Während des Studiums erhalten die Studierenden wertvolle Inhalte in unseren Living Labs und beschäftigen sich mit Projekten aus der Praxis.

Kontakt
032 321 64 13 (Sekretariat)
wirtschaftsingenieur@bfh.ch

Mehr Informationen
bfh.ch/wirtschaftsingenieurwesen

Titre/Diplôme
Bachelor of Science (BSc)

Forme des études
Études à plein temps (6 semestres), à temps partiel et en cours d'emploi (8 semestres ou emploi du temps individuel) ou bachelor intégrant la pratique pour les titulaires d'une maturité gymnasiale (8 semestres)

Langue d'enseignement
Bilingue allemand/anglais. La moitié du cursus est enseignée en allemand, l'autre en anglais.

Majors (orientations)
Dans le dernier tiers de leurs études, les étudiant-e-s choisissent un major qui imprime un cap à leur futur développement professionnel :
- Numérisation – Business Engineering
  Conception de processus de gestion et d'innovation pour des entreprises conventionnelles et numériques, gestion des processus d'affaires, analyse et visualisation des données, conception de produits et de services, méthodes d'innovation.
- Industrie 4.0 – Industrial Engineering
  Systèmes de production et de gestion de la production, recherche opérationnelle, simulation des processus d'entreprise, systèmes de planification des ressources pour la production.
- Supply Chain et Process Engineering
  Réseaux de création de valeur, rôle qu'y joue une entreprise, processus internes et externes, Advanced Process Analysis and Automation, économie circulaire, technologies et systèmes d'information dans la logistique.

Minors (dominantes)
- Énergie et durabilité
- Entrepreneuriat
- et plus

Travail de fin d'études
Pendant leur formation, les étudiant-e-s acquièrent un savoir précieux dans nos Living Labs et se consacrent à des projets issus de la pratique.

Contact
032 321 64 13 (secrétariat)
wirtschaftsingenieur@bfh.ch

Pour en savoir plus
bfh.ch/ingenieriedegestion

Title/degree
Bachelor of Science (BSc)

Mode of study
Full-time study (6 semesters) or part-time study while working (8 semesters or individual timetable); work-study bachelor's degree programme (WSB) for holders of a general baccalaureate (8 semesters)

Teaching language
Bilingual German-English. Half of the modules are taught in German and half in English.

Majors (specialisations)
In the final third of their programme, students choose a major, setting the course for their future career paths:
- Digitisation – Business Engineering
  Design of management and innovation processes for conventional and digital companies, business process management, data analysis and visualisation, product and service design, innovation methods.
- Industry 4.0 – Industrial Engineering
  Production systems and management, operations research, simulation of operational processes, resource planning systems for production.
- Supply Chain and Process Engineering
  Value-creation networks, the role companies play in them and related internal and external corporate processes, advanced process analysis and automation, circular supply chains, technology and information systems in logistics.

Minors (focuses)
- Energy and Sustainability
- Entrepreneurship
- and more

Graduation thesis
During their studies, students learn valuable skills in our Living Labs and complete practical projects.

Contact
032 321 64 13 (secretariat)
wirtschaftsingenieur@bfh.ch

More information
bfh.ch/industrial-engineering

Interviews mit Studierenden
Interviews d’étudiant-e-s
Interviews with students

Bleona Istogu

Warum haben Sie sich für dieses Studium entschieden?
Nach einer kaufmännischen Ausbildung ist es möglich, aber aktuell noch nicht vielen bekannt, den Studiengang Wirtschaftsingenieurwesen zu absolvieren. Ich persönlich fand die Technik und Informatik schon immer sehr interessant. Trotz meiner passenden Stärken fand ich kein grosses Interesse daran, lebenslang im kaufmännischen Bereich zu bleiben. Für mich hat sich das Interesse für Technik und Informatik nochmals verstärkt, als ich während der Berufsmaturität etwas mehr mit diesen Themen Kontakt hatte. Beim Durchstöbern der möglichen Studiengänge bin ich auf das Wirtschaftsingenieurwesen gestossen. Ich konnte mich gut damit identifizieren, da hier die Wirtschaft mit der Technik und Informatik verbunden wird und man sowohl mit kaufmännischer oder technischer Vorbildung den Studiengang wählen kann. Vor allem hat mich jedoch das Vorstellungsvideo der BFH zum Studiengang Wirtschaftsingenieurwesen überzeugt. Dort wurde die Vertiefung Industrial Engineering vorgestellt, für welche ich mich schlussendlich auch entschieden habe und immer noch sehr zufrieden bin. Ich kann diese Vertiefung aus voller Überzeugung weiterempfehlen.

Was gefiel Ihnen besonders gut an diesem Studium?
Mir gefiel besonders gut die Vielseitigkeit dieses Studiums. Es ist breit angelegt und bietet die Möglichkeit, seine Stärken zu entdecken und sich in einem Bereich dank den Vertiefungen zu spezialisieren. Neben der Vermittlung von akademischen Fähigkeiten wird auch viel Wert auf Soft Skills gelegt, was für die berufliche Entwicklung und den zukünftigen Werdegang von grosser Bedeutung ist. Diese ganzheitliche Ausrichtung unterstützt die persönliche Entwicklung enorm.

Wie sah der Studienalltag aus?
Zu Beginn verlief der Studienalltag sehr strukturiert. Wir hatten viele Vorlesungen, damit wir uns die nötigen Grundlagen aneignen konnten und der Stundenplan war fest geplant. Mit der Zeit wurden die Semester flexibler, da wir mehr Projekte hatten, an denen wir arbeiten konnten, und jeder nach seinen Interessen Wahlmodule besuchen durfte, was den Studienalltag

noch spannender gestaltete. Generell hatten alle Semester ihre Vor- und Nachteile und es war eine schöne Zeit.

Arbeiteten Sie nebenher (während des Semesters oder während der Ferien)?
Ich absolvierte mein Studium im Teilzeit-Modell. Zu Beginn arbeitete ich in einem kleineren Pensum von 30-40% im kaufmännischen Bereich, da ich keinen grossen Zusammenhang zum Studium sah. Nachdem ich genug Wissen erlangt hatte, um mich mutig einer anderen Branche zu stellen, wechselte ich in die Industrieautomation und konnte nebenbei zu 60% arbeiten.

Was waren die grössten Herausforderungen im Studium?
Die grösste Herausforderung im Studium war für mich das Zeitmanagement. Als Teilzeitstudentin musste ich meine Disziplin und Selbstorganisation auf die Probe stellen, um sowohl meinen beruflichen als auch schulischen Verpflichtungen gerecht zu werden. Ich musste meinen Alltag und Lebensstil anpassen, da ich nicht mehr so viel Freizeit hatte wie zuvor und der Aufwand für das Studium drastisch höher war als für die Berufsmaturität. Doch nach einer Weile gewöhnt man sich an den neuen Alltag und kommt gut zurecht.

Das Studium war sehr interessant, aber auch arbeitsintensiv. Es war wichtig, eine Balance zu finden und ab und zu meinen Hobbys nachzugehen. Zum Glück wurde dies vom Studiengang sehr unterstützt und wir adressierten dort, auch eben diese Balance zu erreichen.

Was möchten Sie nach dem Studium machen und was machen Sie heute beruflich?
Aktuell bin ich als Junior Engineer in der Industrieautomation angestellt und unter anderem für Installationen und Konfiguration von Servern, Workstations und Systemen sowie für die Mithilfe bei Erstellung von Sicherheitskonzepten und Unterstützung bei der IT-Infrastruktur in-house zuständig. Nach dem Studium möchte ich mein Wissen in Konzeptionierung, Design und Realisierung von sicheren und hochverfügbaren IT- und OT-Systemen im industriellen Umfeld erweitern. Auf jeden Fall werde ich den Abschluss des Studiums geniessen und mehr reisen.

Inwiefern können Sie von Ihrem Studium profitieren?
Man profitiert vielseitig. Einerseits erlebt man persönlich eine grosse Entwicklung. Andererseits merkt man schulisch, dass man mit der Zeit mehr Ausdauer hat. Es ist eine sehr interessante Zeit und man hat auch Freude daran, die eigenen Fortschritte mitzuerleben. Wenn ich das erste Semester mit dem aktuellen vergleichen würde, dann sind dies zwei verschiedene Dimensionen.

Welchen Tipp haben Sie für jemanden, der dieses Studium in Betracht zieht?
Wenn du noch unsicher bist, welchen beruflichen Weg du einschlagen möchtest und viele Interessen in den Bereichen Technik, Informatik und Wirtschaft hast, könnte dieses Studium die richtige Wahl für dich sein.

Dieses Studium bietet eine vielseitige moderne Ausbildung, die es dir ermöglicht, Einblicke in alle drei Schwerpunkte zu gewinnen: Wirtschaft, Technik und Informatik. Im Laufe der Zeit wirst du feststellen, wo deine Leidenschaft und deine Stärken liegen. Viele meiner Kommilitonen haben während ihres Studiums ihre Berufswahl überdacht und neue Wege eingeschlagen, nachdem sie herausgefunden haben, was sie wirklich begeistert und wo sie sich ihre Zukunft vorstellen können.

Das Spektrum der möglichen Berufe nach Abschluss dieses Studiums ist breit gefächert, vom Ingenieur über den SAP-Berater bis hin zum Banker, Business Analyst, Entwickler oder Scrum Master. Die Vielfalt an Karrieremöglichkeiten zeigt deutlich, wie flexibel und vielseitig dieses Studium ist.

Interviews mit Studierenden
Interviews d'étudiant-e-s
Interviews with students

Simon Tschachtli

Warum haben Sie sich für dieses Studium entschieden?
Ich habe mich für das Studium im Bereich Wirtschaftsingenieurwesen mit dem Schwerpunkt Industrial Engineering entschieden, weil ich fest davon überzeugt bin, dass die Digitalisierung alle Bereiche unseres Lebens betrifft und auch in Zukunft einen immer grösseren Einfluss auf die Industrie haben wird. Die Möglichkeit, komplexe technische Prozesse mit betriebswirtschaftlichem Know-how zu optimieren und so Unternehmen dabei zu unterstützen, wettbewerbsfähig zu bleiben und nachhaltiges Wachstum zu erzielen, hat mich besonders gereizt.

Was gefiel Ihnen besonders gut an diesem Studium?
Mir gefällt besonders die persönliche Betreuung in kleinen Klassen und der aktive Unterricht. Der praxisnahe Ansatz, komplexe Probleme zu lösen, sowie die Möglichkeit, mit Unternehmen zusammenzuarbeiten, bieten wertvolle Erfahrungen. Die Lehrpersonen mit Industrieerfahrung bereichern den Unterricht und vermitteln praxisnahe Einblicke.

Wie sah der Studienalltag aus?
Zu Beginn des Studiums wurde man intensiv gefordert. Der Alltag war gefüllt mit verschiedenen Grundlagenfächern. Die Menge an zu erlernender Theorie sollte dabei nicht unterschätzt werden. Inzwischen beschäftigt man sich intensiver mit diversen Projekten, die meist ausserhalb der Hochschule in Zusammenarbeit mit Unternehmen absolviert werden. Dadurch bietet sich die Möglichkeit, die erlernte Theorie und Organisationsfähigkeiten direkt in der Praxis anzuwenden. Insgesamt unterscheidet sich der Alltag zwischen den verschiedenen Semestern deutlich, wobei der Fokus zunehmend auf praxisorientierten Projekten liegt.

Arbeiteten Sie nebenher (während des Semesters oder während der Ferien)?
Ein Vollzeitstudium, ohne jegliche finanzielle Unterstützung zu bestreiten, ist schwierig. Glücklicherweise wurde ich tatkräftig von meiner Familie unterstützt. Um den Arbeitsfluss aufrechtzuerhalten und zusätzliches Einkommen zu generieren, habe ich während den Semesterferien gearbeitet. Gelegentlich habe ich auch

während des Semesters gearbeitet, wenn es sich anbot, jedoch habe ich stets darauf geachtet, dass meine schulischen Prioritäten im Vordergrund stehen.

Was waren die grössten Herausforderungen im Studium?
Die grössten Herausforderungen im Studium waren einerseits die Bewältigung des breiten Themenspektrums, das von den Naturwissenschaften über Informatik bis hin zur Buchhaltung reichte. Diese Vielfalt erforderte eine hohe Anpassungsfähigkeit und die Fähigkeit, sich schnell in neue Themen einzuarbeiten. Andererseits war es zudem wichtig, stets organisiert zu sein, um den Überblick über die verschiedenen Kurse und Aufgaben zu behalten. Besonders während der Prüfungsphasen war es eine Herausforderung, dranzubleiben und kontinuierlich zu lernen, um die Anforderungen erfolgreich zu bewältigen.

Was möchten Sie nach dem Studium machen und was machen Sie heute beruflich?
Nach meinem Bachelor-Abschluss wird mein Studienweg voraussichtlich noch nicht abgeschlossen sein. Meine Absicht ist es, den Master in Engineering zu absolvieren, um meine Kenntnisse in den Ingenieurwissenschaften zu vertiefen und weitere Forschungsgebiete zu erkunden. Dieser Schritt wird mir ermöglichen, mich fachlich weiterzuentwickeln und mich noch intensiver mit den Herausforderungen und Innovationen in meinem Fachgebiet auseinanderzusetzen.

Inwiefern können Sie von Ihrem Studium profitieren?
Mein Studium ermöglicht es mir, von verschiedenen Aspekten zu profitieren: Ich erhalte ein fundiertes Wissen über den aktuellen Stand der Technik, das mir ermöglicht, in einer sich ständig wandelnden Arbeitswelt wettbewerbsfähig zu bleiben. Zudem fördert das Studium meine Fähigkeit zur Problembetrachtung und -lösung, was essenziell für eine erfolgreiche Karriere im Bereich des Wirtschaftsingenieurwesens ist. Mein Auslandssemester in Litauen hat mir nicht nur interkulturelle Kompetenzen vermittelt, sondern auch meine Perspektive erweitert und mir ermöglicht, in einem anderen Land zu leben und zu studieren. Darüber hinaus bietet mir mein Studium die Möglichkeit, interessante Persönlichkeiten wie Dozierende und Vertreter*innen von Unternehmen kennenzulernen, von deren Erfahrungen und Einblicken ich profitieren kann.

Welchen Tipp haben Sie für jemanden, der dieses Studium in Betracht zieht?
Für jemanden, der das Studium in Wirtschaftsingenieurwesen in Betracht zieht, würde ich folgende Ratschläge geben: Organisation ist das A und O. Es ist wichtig, den Überblick über die verschiedenen Themen und Aufgaben zu behalten und sich frühzeitig zu organisieren. Zudem sollte man sich nicht von dem breiten Themenspektrum abschrecken lassen, das im Studium behandelt wird. Es ist normal, dass man sich in verschiedenen Bereichen bewegt, und wichtig, offen für neue Herausforderungen zu sein. Kontinuierliche Teilnahme am Unterricht und das aktive Bemühen, das Gelernte zu verstehen, sind ebenfalls entscheidend. Schliesslich sollte man sich nicht entmutigen lassen, falls man einmal ein schlechtes Ergebnis erhält. Es ist wichtig, aus Fehlern zu lernen und sich kontinuierlich zu verbessern.

Interviews mit Studierenden
Interviews d’étudiant-e-s
Interviews with students

Moritz Mahnig

Warum haben Sie sich für dieses Studium entschieden?
Nachdem ich meine Ausbildung als Konstrukteur abgeschlossen hatte, war mir schnell klar, dass ich mich weiterentwickeln wollte. Um herauszufinden, welcher Studiengang am besten zu meinen Interessen und Zielen passt, besuchte ich verschiedene Präsentationen und Informationsveranstaltungen. Durch mein Interesse am Programmieren und an Wirtschaft stiess ich auf den Studiengang Wirtschaftsingenieurwesen. Die Kombination aus Informatik, Wirtschaft und Technik fand ich dabei besonders interessant.

Was gefiel Ihnen besonders gut an diesem Studium?
Man wird zu Beginn des Studiums sehr gut abgeholt. Je nach Vorbildung gibt es verschiedene Konvergenzmodule, um eventuelle Lücken in den Grundlagen zu schliessen, die andere Studierende möglicherweise bereits durch ihre vorherige Ausbildung abgedeckt haben. Ein weiterer Pluspunkt aus meiner Sicht sind die verschiedenen Projekte während der Semester. Diese erlauben es, Interessen zu vertiefen und das Gelernte direkt anzuwenden. Zudem ist der Studiengang sehr praxisorientiert. So werden beispielsweise im Business Engineering 3 durch Case-Studies reale Unternehmensstrategien und -situationen analysiert und diskutiert.

Wie sah der Studienalltag aus?
Anfang des Studiums war alles sehr klar strukturiert durch die Präsenzvorlesungen in Biel. Im Verlauf der weiteren Semester gewann das Selbststudium an Stellenwert, dadurch konnte ich meinen Studienalltag individuell gestalten. Zudem hatten wir auch mehr Projekte, in denen wir das Gelernte direkt anwenden konnten. Grundsätzlich habe ich aber viel Zeit mit meinen Kommilitonen verbracht und auch immer mit ihnen Mittag gegessen. Am Abend habe ich oftmals noch Aufträge erledigt oder an Projekten gearbeitet.

Arbeiteten Sie nebenher (während des Semesters oder während der Ferien)?
Während des Studiums habe ich Vollzeit studiert. Je nach Kapazität habe ich an Wochenenden oder auch während den Semesterferien gearbeitet. Allerdings übte ich währenddessen nicht meinen erlernten Beruf aus, sondern arbeitete in anderen Tätigkeitsbereichen.

Was waren die grössten Herausforderungen im Studium?
Die grössten Herausforderungen waren Zeitmanagement und Gruppenarbeiten. Teilweise war es schwierig, mit dem Lernstoff aller Module Schritt zu halten und vorbereitet in die Vorlesungen zu gehen, besonders in stressigen Phasen mit vielen Abgaben. Zudem hatten wir oft verschiedene Projekte in unterschiedlichen Teams. Dies erforderte eine gute Absprache mit den anderen Teammitgliedern, damit jeder seine Ideen einbringen und trotzdem individuell daran arbeiten konnte.

Was möchten Sie nach dem Studium machen und was machen Sie heute beruflich?
Mein Ziel ist es, im Herbst eine Anstellung zu finden und das erworbene Wissen aus dem Studium in der Praxis anzuwenden und zu vertiefen. Durch das Studium wurde mein Interesse an Data Science geweckt und ich würde mich gerne in diesem Bereich weiterentwickeln. Dazu plane ich in den nächsten Jahren ein Master-Studium im Bereich Business Engineering mit Vertiefung Data Science zu machen.

Inwiefern können Sie von Ihrem Studium profitieren?
Man hat eine sehr gute Basis durch die Kombination aus Informatik, Technik und Wirtschaft. Diese interdisziplinäre Ausbildung ermöglicht es mir, Probleme aus den verschiedenen Bereichen zu verstehen und anzugehen. Ich denke, solche «Brückenbauer» sind heute wie auch in der Zukunft sehr gefragt. Zudem hilft mir das Studium, effektive Lösungen zu entwickeln und Innovationen voranzutreiben.

Welchen Tipp haben Sie für jemanden, der dieses Studium in Betracht zieht?
Im Studienalltag ist Eigeninitiative entscheidend. Es ist wichtig, frühzeitig Unterstützung zu suchen, wenn man Schwierigkeiten mit dem Unterrichtsstoff hat. Oftmals hilft es, mit den Kommilitonen Lerngruppen zu bilden. Das fördert nicht nur eine effizientere Problemlösung, sondern macht meistens auch mehr Spass.

ziemer
OPHTHALMOLOGY

HighTech Familiär Global

Das Medizintechnik-Unternehmen mit einer Vision für die Augenchirurgie.

Bewirb dich jetzt!
www.ziemergroup.com

Zusammenarbeitsformen
Formes de collaboration
Collaboration

Neue Erkenntnisse gewinnen, Synergien schaffen, Praxisnähe erfahren: Die Berner Fachhochschule arbeitet in der angewandten Forschung und Entwicklung eng mit der Wirtschaft und der Industrie zusammen. Dadurch wird die Verknüpfung von Forschung und Lehre gestärkt und es fliesst neues Wissen in den Unterricht ein. Dies führt zu einer qualitativ hochwertigen und praxisnahen Lehre. Damit Unternehmen bereits heute die Spezialistinnen und Spezialisten von morgen kennenlernen oder sich an eine Thematik herantasten können, besteht die Möglichkeit, Projekt- oder Abschlussarbeiten in Zusammenarbeit mit Studierenden durchzuführen. Als Wirtschaftspartner können Sie Themen vorschlagen. Werden Themen gewählt, bearbeiten Studierende diese alleine oder in kleinen Gruppen in dafür vorgesehenen Zeitfenstern selbstständig. Dabei werden die Studierenden von ihrer Fachperson sowie einer Dozentin oder einem Dozenten der Berner Fachhochschule betreut. Die Rechte und Pflichten der beteiligten Parteien werden in einer Vereinbarung geregelt.

Möchten Sie Themen für studentische Arbeiten vorschlagen und mehr über eine mögliche Zusammenarbeit erfahren? Kontaktieren Sie uns und überzeugen Sie sich vom Innovationspotenzial unserer Studierenden.

bfh.ch/ti/projektidee

Acquérir de nouvelles connaissances, créer des synergies, découvrir la pertinence pratique : dans le domaine de la recherche appliquée et du développement, la Haute école spécialisée bernoise travaille en étroite collaboration avec l'économie et l'industrie. Le lien entre la recherche et la formation est ainsi renforcé et l'enseignement profite des nouvelles connaissances. Il en résulte une formation de grande qualité, axée sur la pratique. Pour que les entreprises puissent faire aujourd'hui déjà la connaissance des spécialistes de demain ou aborder un sujet particulier, elles ont la possibilité de réaliser des projets ou des travaux de fin d'études en collaboration avec des étudiant-e-s. En tant que partenaire économique, vous pouvez proposer des thèmes. S'ils sont choisis, les étudiant-e-s les traitent ensuite de manière autonome, seul-e-s ou en petits groupes, dans les créneaux horaires prévus à cet effet. Ils et elles sont encadré-e-s par votre spécialiste ainsi que par un-e enseignant-e de la Haute école spécialisée bernoise. Une convention régit les droits et obligations des parties au projet.

Souhaitez-vous proposer des thèmes pour des travaux d'étudiant-e-s et en savoir plus sur une éventuelle collaboration ? Contactez-nous et laissez-vous convaincre par le potentiel d'innovation de nos étudiant-e-s.

bfh.ch/ti/idee-projet

Gain new insights, create synergies, experience practical relevance: Bern University of Applied Sciences BFH works closely with business and industry in areas of applied research and development. This strengthens the link between research and education, allowing new knowledge to flow into our teaching, which leads to high-quality and practice-oriented degree programmes. In order for companies to meet our future specialists or to explore a topic, they can carry out projects or theses in cooperation with our students. As a business partner, you can suggest topics. Once these topics are selected, the students work on the projects independently, either individually or in small groups, within designated time frames. They are supervised by both your specialist and a BFH lecturer. The rights and obligations of the parties involved are set out in a written agreement.

Would you like to suggest topics for student projects and find out more about a possible cooperation? Contact us and convince yourself of the innovation potential of our students.

bfh.ch/ti/projectidea

Studentische Arbeiten | Travaux d'étudiant-e-s | Student projects
Das Modell einer flexiblen Zusammenarbeit mit Industrie und Wirtschaft wird in studentischen Arbeiten erfolgreich umgesetzt:
La flexibilité du modèle de collaboration avec l'industrie et l'économie se concrétise avec succès dans les travaux d'étudiant-e-s :
The model of flexible cooperation with industry and business is successfully implemented in student projects:

Semesterarbeiten, Bachelor-Thesis, Master-Thesis
Travaux de semestre, travail de bachelor, mémoire de master
Semester projects, bachelor thesis, master thesis

Wochen bis Monate
De quelques semaines à plusieurs mois
Several weeks or months

Kostenbeitrag zulasten des Auftraggebers
Frais à charge du donneur d'ordre
Costs are at the expense of the client

Auftragsforschung und Dienstleistungen | Recherche sous contrat et prestations de service | Contract Research and Services
Wir bieten Auftragsforschung und erbringen vielfältige Dienstleistungen für unsere Kundinnen und Kunden (inkl. Nutzung der BFH-Infrastruktur sowie des Forschungsnetzwerkes). | Nous effectuons des recherches sous contrat et fournissons une vaste palette de prestations de services à nos clientes et clients – y compris l'utilisation des infrastructures BFH et du réseau de recherche. | We carry out contract research and provide a wide range of services for our clients, such as exclusive use of the BFH infrastructure and the research network.

Planung, Coaching, Tests, Expertisen, Analysen;
durchgeführt von Expertinnen und Experten
Planification, coaching, tests, expertises, analyses par des expert-e-s
Planning, coaching, tests, expertise, analysis: done by experts

Wochen bis Monate
De quelques semaines à plusieurs mois
Several weeks or months

Marktübliche Preise
Prix du marché
Prevailing prices

F&E-Kooperationen | Coopérations R&D | R&D Collaboration
Die BFH-TI erbringt Leistungen im Bereich der angewandten Forschung und Entwicklung:
La BFH-TI fournit des prestations de service dans le domaine de la recherche appliquée et du développement :
BFH-TI provides services in Applied Research and Development:

Kooperationen mit Fördermitteln – mittlere und grössere Projekte mit:
Coopérations bénéficiant de subventions – projets de moyenne et grande envergure avec :
Public Aid – medium and large-sized projects with:

Innosuisse, SNF / FNS / SNSF, EU / UE

Monate bis Jahre
De quelques mois à plusieurs années
Several weeks or months

Teilfinanziert durch
öffentliche Fördergelder
Financement partiel par
des subventions publiques
Partly public funding

Industriepartner
Partenaires industriels
Industry partners

Eine enge Zusammenarbeit mit Industriepartnern ist uns äusserst wichtig. Zahlreiche Abschlussarbeiten sind in Kooperation mit Firmen aus der ganzen Schweiz entstanden. Wir bedanken uns bei diesen Firmen für die fruchtbare Zusammenarbeit!

bfh.ch/ti/forschung

À nos yeux, une collaboration étroite avec des partenaires industriels est extrêmement importante. De nombreux mémoires se font en partenariat avec des entreprises de toute la Suisse. Nous remercions ces entreprises pour cette fructueuse collaboration !

bfh.ch/ti/recherche

A close cooperation with industrial partners is very important to us. Numerous bachelor's theses have been produced in cooperation with companies from Switzerland. We thank these companies for the fruitful collaboration!

bfh.ch/ti/research

Actemium Schweiz AG, Ittigen
Aeschlimann AG Décolletages, Lüsslingen
Bern University of Applied Sciences, Biel
Berner Fachhochschule BFH, Biel/Bienne
Berner Fachhochschule, Wirtschaftsingenieurwesen, Biel
Fritz Studer AG, Steffisbrug
Infotech AG, Solothurn
JAG Jakob AG, Brügg
Komax Holding AG, Dierikon
POWDIENCE, Biel
SBB AG, Bern
SBB CFF FFS, Bern
Schweizer Zucker AG, Aarberg
Strähl Décolletage AG, Leuzigen
Swiss m4m Center, Bettlach
Swiss Post, Dintikon
Syphon AG, Brügg bei Biel
Teltronic AG, Biberist
Zesar.ch, Tavannes

Liste der Studierenden
Liste des étudiant-e-s
List of students

Im Folgenden präsentieren wir Ihnen die Zusammenfassungen der Abschlussarbeiten des Jahres 2024.

Die Studierenden sind in alphabetischer Reihenfolge aufgeführt.

Die Studierenden haben die Texte – teils mit Unterstützung der betreuenden Dozierenden – selbst verfasst. Die Texte wurden vor Publikation nicht systematisch redigiert und korrigiert.

Ci-après, nous vous présentons les résumés des travaux de fin d'études de l'année 2024.

Les étudiant-e-s sont présenté-e-s par ordre alphabétique.

Ils et elles ont rédigé les textes de façon autonome, parfois avec l'aide des enseignant-e-s qui les encadrent. Les textes n'ont pas systématiquement été relus ou corrigés avant publication.

On the next pages, we have summarised the 2024 graduation theses.

The students are listed in alphabetical order.

The texts were written by the students themselves, with some support from their lecturers. They were not systematically edited or corrected before publication.

Business Engineering

Market analysis for expansion strategy of high-precision manual workstations

Degree programme: BSc in Industrial Engineering and Management Science
Thesis advisor: Prof. Dr. Bastian Widenmayer
Expert: Thomas Blaser
Industrial partner: Zesar.ch, Tavannes

The niche market of high-precision manual workstations challenges manufacturers in Switzerland to ensure sustainable growth. Companies in this sector must navigate a unique set of obstacles, including high competition, evolving technology, and a limited customer base. This study aims to identify and analyze various market opportunities to determine the best solution for overcoming these challenges and achieving sustained long-term success.

Julien Bouquet
julien@sensemail.ch
Business Engineering

Introduction and Objective

Zesar.ch is a leading Swiss manufacturer of high-precision manual workstations, which are essential for the assembly of luxury watches and are characterized by precision and ergonomic design. However, despite its outstanding performance, Zesar.ch faces challenges such as niche markets and the trend towards digitalization. Using the research question „Which new market opportunities exist for Swiss manufacturers of high-precision manual workstations outsides the watch industry and what are these opportunities in terms of market size, product-market fit and market entry?“, I am examining the strategic opportunities for Zesar.ch's expansion into new markets to ensure sustainable growth in a changing industry landscape.

Research Design

The study follows a multi-method approach involving desk research, site visits, and interviews with stakeholders. Firstly, I used the General Classification of Economic Activities (NOGA) code to identify all industries performing precision manual labor, determine the number of companies and full-time equivalents, and validate this data against the structural survey. Secondly, I analyzed the shortage of skilled workers based on existing studies in the respective industries. By examining the competition's portfolio and customers through internet research, existing documents, and direct contact with manufacturers, the study analyzed the competitive landscape. I then conducted a scenario-based market volume analysis for the various markets, considering best, worst, and base case scenarios using the previously collected data. Through semi-structured interviews accompanied by site visits, which were transcribed and thematically coded, I verified the market size and gained deeper insights. This process enabled market segmentation, identification of key features, and determination of acceptable price ranges for workstations. Finally, I calculated the potential annual units sold and turnover in each segment.

Results

I identified a total of 21 different NOGA codes, all classified as significant to moderate in the skilled labor shortage index. I found 15 competitors, six of which supply not only the watch market but also jewelers or MedTech. The industries identified are divided into seven markets, with the watch market being the largest in terms of units and turnover, followed by the laboratory, cleanroom, and MedTech markets (see Figure 1 for market size and respective CAGR from 2018 to 2021). Each is segmented into premium, medium, and budget, with only the premium segment being relevant for Zesar.ch. The key features I identified are ergonomic and modular design, stability and durability, with price ranges varying by market but generally between CHF 10,000 and CHF 30,000.

Implications and recommendations

Based on the results and Zesar's competencies, the study recommend that Zesar.ch targets the luxury watch market, followed by jewelry manufacturers and the laboratory market. The key features identified should be highlighted in marketing as they reduce absenteeism, improve well-being and increase productivity. Additionally, continuous monitoring of market changes is essential.

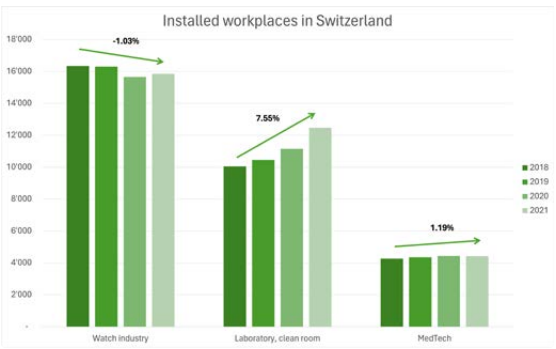


Figure 1: Development of the workplaces in the three largest industries between 2018 and 2021

Developing a Business Intelligence Tool to Quantify and Communicate Circular Economy Impacts

Degree programme: BSc in Industrial Engineering and Management Science
Thesis advisor: Dr. Maria Franco Mosquera
Expert: Adrian Stettler
Industrial partner: Syphon AG, Brügg bei Biel

This project describes the development of a comprehensive Business Intelligence (BI) tool for Syphon AG to measure and communicate the environmental and social impacts of their circular economy practices. By identifying and deploying key indicators like CO2-Equivalence emissions and social metrics such as employee diversity and integration, the tool enhances stakeholder engagement and improves decision-making.

Introduction and Objectives

Syphon AG, a Swiss non-profit, advances circular economy practices in construction. By repurposing components and employing individuals from supported sectors, it cuts waste and CO2 emissions from new material production. This project developed a BI tool to measure and showcase Syphon's environmental and social impacts. The tool calculates the cradle-to-gate CO2 equivalence of reused items and their transport and features a dynamic dashboard highlighting the company's contributions.

Research Design

By firstly engaging in a comprehensive literature review, a basic understanding is developed of what circularity and its aspects entail as well as what options of tools and assessments exist and are currently being used. The development of means to calculate the metric of choice, CO2 equivalence, follows and is being employed by taking a sample of the 50 highest revenue items and compare them with existing databases (Ecoinvent) and/or Environmental Product Declarations (EPD's). Lastly, by interviews with Syphon AG, KPI's and visualizations are determined. Social metrics in Syphon AG's context are measured by evaluating data on workforce demographics, employment of marginalized groups, community engagement, and the social benefits provided through their circular economy practices. This involves quantifying aspects like job creation, integration of social welfare recipients, and contributions to community well-being.

Results

The resulting tool addresses the three core pillars of circularity: environmental (1), social (2), and economic (3) impacts. The environmental section calculates total CO2-Equivalent emissions, including transport, with Power BI visualizations (Figure 1) highlighting savings from reused products. The social dashboard (Figure 2) displays metrics on social integration and circularity. The economic dashboard links cross-valued KPIs to these pillars, generating new metrics and insights. This approach simplifies the assessment and communication of Syphon AG's performance, providing dynamic visualizations tailored to internal needs and external stakeholder interests.

Implications and Recommendations

This tool significantly enhances Syphon AG's ability to communicate their environmental and social circular benefits to stakeholders. The environmental dashboard provides clear visualization of CO2-Equivalence emissions, reinforcing Syphon AG's commitment to sustainability and environmental circularity. Future enhancements should integrate expand lifecycle analysis capabilities as well as further automation via Artificial Intelligence. By continuously refining these features, Syphon AG can maintain its leadership in sustainable construction practices.

Andrej Briggeler
Business Engineering

Figure 1: Environmental Assessment Dashboard

Figure 2: Social Assessment Dashboard

Deep Learning for Tree Detection and Measurement with LiDAR Data

Degree programme: BSc in Industrial Engineering and Management Science
Thesis advisor: Florian Thürkow
Expert: Dr. Jens Birger

In the context of global climate change and increasing deforestation, the importance of sustainable forest management is evident. This scientific work aims to enhance the accuracy and efficiency of forest inventory and tree detection by investigating the potential of Switzerland's area-wide LiDAR data from the Federal Office of Topography, swisstopo for tree detection.

Sandro Conconi
Business Engineering

Introduction and Objectives

Today's manual methods for tree surveying and maintaining a tree inventory are time-consuming. For this reason, LiDAR technology with its three-dimensional point clouds could be a cutting-edge solution for the detection and measurement of trees. The aim of this research is to explore how the use of LiDAR data, which is available for almost the entirety of Switzerland, can achieve these requirements. The primary objective is to improve the efficiency and accuracy of forest inventories and to investigate how this high-precision LiDAR data can contribute to the automatic detection of individual trees.

Methods

This thesis focuses on four objectives:

- Analysis and evaluation of existing research
- Creation of a dataset utilizing the tree inventory of the city of Zurich and LiDAR data from swisstopo
- Training of the deep learning model for automatic recognition in point clouds, including various preprocessing steps
- Evaluation of the model's performance using a dedicated test dataset; all data analysis and practical implementation is conducted using Python and the deep learning model PointNet

Results

The findings reveal that using LiDAR data for tree detection with deep learning is feasible, but the data quality and dataset balance are the main factors affecting the performance of a deep learning model. In addition to the deep learning model, the research also investigated the accuracy of LiDAR data and confirmed that the developed methods can provide high-quality results. The results clearly demonstrate the ability to use the obtained data for this purpose, showing that the determination of height and positioning based on the developed approaches is possible with a tolerance of 1 cm.

Implications and Recommendations

The results of this study underscore the significant promise of combining LiDAR and deep learning for forestry, offering a robust tool for data collection and analysis. Additionally, this research serves as a valuable foundation for future research. It is recommended that subsequent and targeted research be undertaken in the fields of dataset enhancement, tree segmentation, and the refinement of deep learning models.

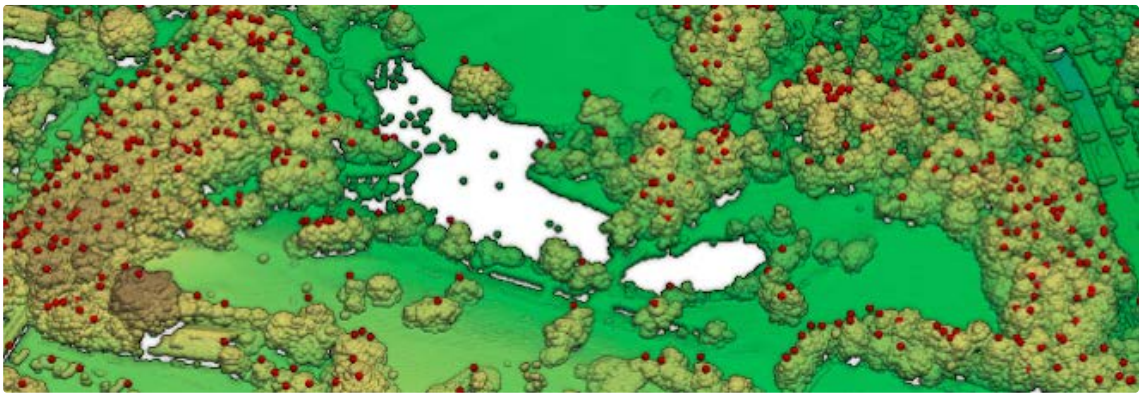


Figure 1: Tree identification based on the methods and models developed

Potential Analysis for the use of Enterprise GPT in Process Engineering

Degree programme: BSc in Industrial Engineering and Management Science
Thesis advisor: Patrik Marti
Expert: Moritz Maier
Industrial partner: Schweizer Zucker AG, Aarberg

In response to the increasing need for efficient processes and rapid knowledge transfer within industries, this bachelor thesis explores the potential application of Enterprise Generative Pre-trained Transformer (GPT) systems in the process engineering sector of Schweizer Zucker AG. The primary goal is to analyze how such AI-driven systems can improve the training and knowledge transfer of new shift supervisors into the production processes.

Introduction and Objectives

The digital transformation presents opportunities and challenges for traditional industries like Schweizer Zucker AG. This study was motivated by the need to streamline the onboarding of new shift leaders (Figure 1) and to maintain high operational efficiency despite the complexity of production processes. Initially, the idea of using a digital twin was considered but was deemed impractical due to constant changes and the complexity of plant operations. Consequently, the focus shifted to implementing an Enterprise GPT system (Figure 2) capable of understanding production processes and providing real-time support to employees through natural language queries.

Methods

A comprehensive analysis was conducted involving literature reviews, data analysis, and the development of test cases in collaboration with shift leaders. These test cases were designed to simulate production disruptions and evaluate the GPT system's effectiveness in providing relevant information and decision-making support. Additionally, a risk analysis was performed to identify potential hazards associated with relying on AI-generated instructions.

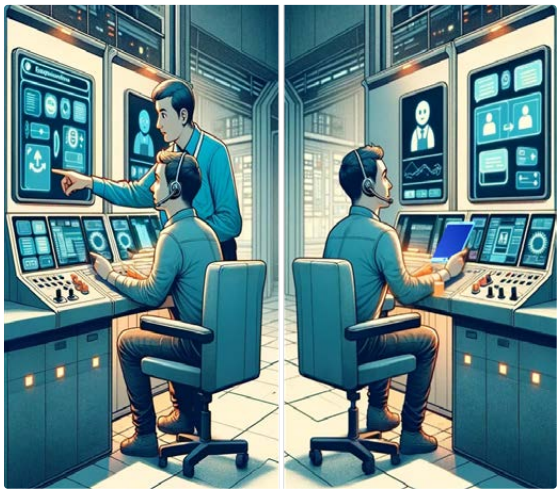


Figure 1; Left: Actual situation during the training of new supervisors / Right: Future situation with a chatbot as support

Results

The analysis revealed that many of the actions performed by the shift supervisors are not documented and are instead memorized through experience. Testing a particular test case with two different chatbots showed that interpreting the data from the existing manuals is a challenge to provide clear action steps for the shift supervisors. The chatbots heavily relied on the troubleshooting documentation provided to them, as these documentation contained detailed step-by-step instructions. Without these specific troubleshooting documentation, it was difficult for the chatbots to provide meaningful instructions, highlighting the need for comprehensive documentation to support effective AI assistance.

Recommendations

To enhance the potential implementation of an Enterprise GPT system, it is recommended to first systematically document all critical actions and disruption scenarios. This data is essential to train an effective GPT model. Additionally, integrating real-time and historical data will provide better context for the system. Starting with a pilot phase for real-world feedback and actively involving shift leaders in the system's development and refinement will further ensure its effectiveness.

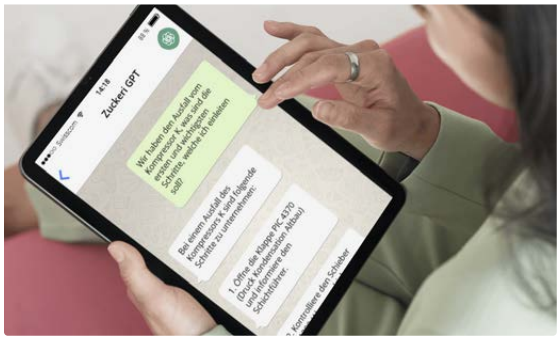


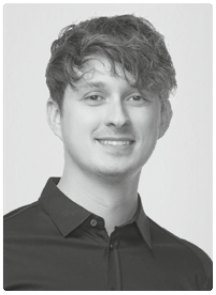
Figure 2; Possible situation in the future when the new shift supervisors get support from a chatbot

Reto Gfeller
Business Engineering

Creating a Data-Driven Customer Analysis and Recommendation Tool for Onlineshops

Degree programme: BSc in Industrial Engineering and Management Science
Thesis advisor: Prof. Bramwell Kaltenrieder
Expert: Tim Luginbühl
Industrial partner: POWDIENCE, Biel

Customer analysis and marketing tools are essential for businesses seeking to understand their customers and enhance their marketing strategies. Recognising the importance of these tools, POWDIENCE is planning to create a customer analysis application designed for the Shopify App Store. This project investigates the challenges businesses encounter and proposes a new application designed to enhance marketing effectiveness and deepen customer insights.



Moritz Nicola Mahnig
moritz.mahnig@gmail.com
Business Engineering

Introduction and Objectives

Customer analysis and marketing applications are critical for SMEs with online sales to refine their marketing strategies through data-driven insights. These tools help identify key target groups, highlight profitable products, and optimise marketing efforts. However, many existing applications necessitate advanced marketing knowledge, are expensive, or fail to provide clear recommendations. Addressing these challenges, this project aimed to develop a prototype for an accessible and affordable application for SMEs, offering clear, actionable recommendations based on data-driven analyses.

Research Design

To understand the marketing and customer analysis challenges SMEs face, six semi-structured interviews were conducted. These interviews revealed significant pain points and problems. Based on these insights, a set of application requirements was established, leading to the creation of an initial mock-up. This mock-up was subsequently validated and refined through feedback from SMEs. Leveraging these insights, a Python application was developed to process Shopify data, delivering various visualisations and key performance indicators and providing actionable recommendations for optimising marketing strategies.

Results

The developed prototype integrates Shopify's API to access relevant data, making it suitable for distribution through the Shopify App Store. The application retrieves data, stores it in a database, and offers 11 different time-based analyses, including customer lifetime value, target groups, and potential product bundling opportunities. It provides actionable recommendations based on insights from POWDIENCE, enabling businesses to conduct data-driven analyses and make informed marketing adjustments.

Implications and Recommendations

This thesis details the development of a prototype that incorporates essential features for customer analysis and marketing. By leveraging Shopify and machine learning technologies, the prototype delivers insightful analyses and recommendations, reducing the time and expertise required for effective marketing. The prototype's usability improves with increased customer interactions and product purchases on Shopify. However, the scope and accuracy of analyses could be enhanced by integrating supplementary data sources, such as social media. Implementing artificial intelligence could offer more personalised, customer-specific recommendations.

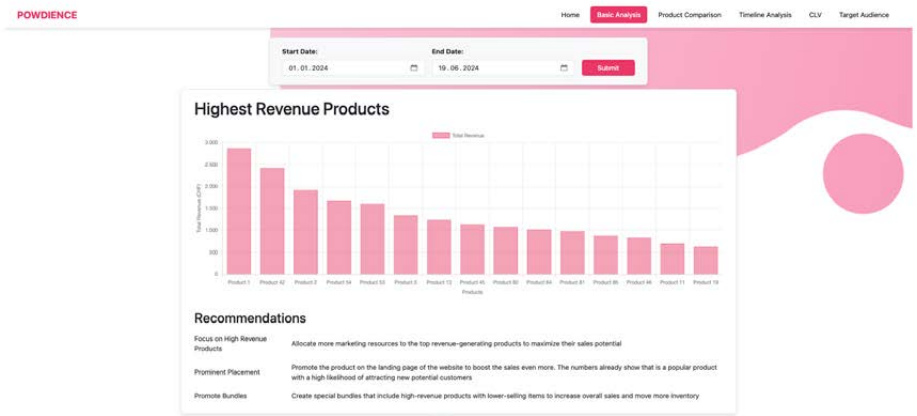


Figure 1: Graphical User Interface of Customer Analysis Application

Meta-Study on Barriers to Digital Transformation

Degree programme: BSc in Industrial Engineering and Management Science
Thesis advisor: Prof. Dr. Bastian Widenmayer
Expert: Dr. Maria Franco
Industrial partner: Berner Fachhochschule, Wirtschaftsingenieurwesen, Biel

This comprehensive meta-study examines the complex landscape of digital transformation and highlights the diverse barriers that impede progress across industries. Through careful analysis of 106 academic articles, this study categorizes the prevailing barriers, thereby enabling organizations to understand the barriers hindering digital transformation and realize the full potential of digital innovation.

Introduction

In the rapidly evolving digital age, companies in various industries face major challenges in adapting to technological progress. This study is based on the urgent need to analyze these challenges and provide a detailed overview of the obstacles that hinder digital transformation efforts. The aim is to methodically categorize these barriers and provide a structured understanding that can help companies navigate their digital transformation journey more effectively.

Method

This thesis adopted a systematic approach based on the PRISMA framework and carefully examined literature from 2016 to 2023. The research included a comprehensive search of major databases, including Google Scholar, IEEE, Web of Science, and Science Direct. A carefully formulated search strategy was created for each database, incorporating specific keywords, Boolean operators, and filtering criteria to ensure the capture of highly relevant papers. The AI tool Elicit was crucial in identifying the barriers to digital transformation based on the selected papers. These barriers were then verified, put in an Excel spreadsheet, categorized, and quantitatively analyzed by frequency appearance and pattern recognition.

Results

The comprehensive research resulted in the identification of eight critical barriers to digital transformation. Financial Barriers were characterized by budgetary limitations and investment difficulties, which particularly affected SMEs. Management and Leadership Challenges highlighted the need for visionary leaders capable of strategically supporting digital initiatives. Technological challenges the most frequently cited barrier, included outdated infrastructure and the complexity of integrating new digital solutions. Legal and Regulatory Barriers encompassed compliance requirements that require careful management. The study also highlighted Cultural and Organizational Barriers, underscoring the need to cultivate and digitally enable organizational culture. The Missing Skill / Lack of Expertise Barrier highlights the urgent need for targeted training programs and targeted acquisition. Resistance to Change Barrier emerged as a psychological barrier and reflects the employee's apprehension towards new technologies and processes, which is often linked to fear of job losses. Finally, Data and Privacy Security Barriers emphasize the need to protect sensitive data from a growing landscape of cyber threats. These barriers have been quantitatively presented in Figure 1, which summarizes the frequency of each barrier derived from the analysis of the 106 academic articles.

Implications and Recommendations

Organizations are encouraged to cultivate a supportive culture and provide strong leadership to effectively manage digital transformation. Technological advances must be accompanied by an awareness of regulation to reduce compliance burdens. Adopting digital tools should be strategically planned, aligning with the organization's overall vision and goals. Using agile methods will not only refine processes but also improve the organization's ability to adapt to the rapidly evolving digital landscape.

Keywords

Digital Transformation, Digitalization, Industry 4.0, Barriers, Challenges, Hurdles, Organizational Barriers, Cultural Barriers, Missing Skills, SMEs

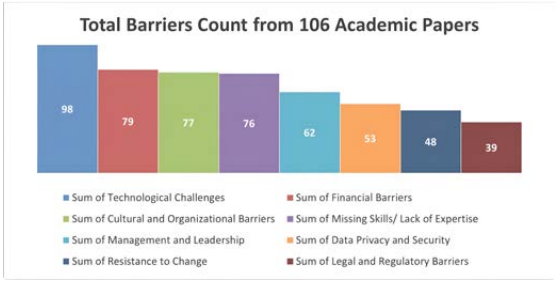


Figure 1: Frequency Distribution of Identified Barriers to Digital Transformation

Billy Bambe Ndawele
bambe@bluewin.ch
Business Engineering

Potential cost savings and process optimization of a drawingless manufacturing

Degree programme: BSc in Industrial Engineering and Management Science
Thesis advisor: Prof. Dr. Bastian Widenmayer
Expert: Moritz Maier
Industrial partner: Fritz Studer AG, Steffisbrug

As part of the digital transformation, the switch from drawing-based to model-based production offers great potential for cost and time savings along the entire process chain. Based on qualitative and quantitative analyses, the study concludes that the investment costs of CHF 84,000 in the sub-area of internal cubic production are amortized in 2.3 years. After that annual savings of CHF 136,000 are realistic. This clearly shows that the changeover is worthwhile.

Jenny Lynn Röthlisberger
Business Engineering

Introduction and Objective of the Thesis

The internal machinery of Fritz Studer AG - a leading producer of cylindrical grinding machines - has been modernized. Now, the processes also need to be updated. The goal is to use cost calculations to identify the savings potential of the sub-process from engineering to the manufactured part, and to use a process analysis to show the process changes and optimization potential. Drawingless manufacturing indicates that production-relevant information is attached directly to the 3D model. The 2D drawing is no longer required and the labelling is now model based.

Research Design

To record the current situation and the requirements for the new process, twelve interviews were conducted with internal stakeholders and one interview with an external expert. The interviews were evaluated using qualitative data analysis with MaxQDA. The results were reflected in an iterative process. For quantitative analysis and to determine the potential time savings, manual time measurements were carried out using reference parts. The time taken to create the model, the drawing, and the PMIs were measured. The processes were drawn according to the BPMN 2.0 standard.

Results

The complex current process shows the causal relationships between the 80 stakeholders involved. For the project to be implemented successfully, it is essential to evaluate the needs of the stakeholders and incorporate them into the implementation. After the changeover, the high-level process remains the same. However, the changes affect individual sub-processes and working methods. The potential time saving of the design engineer are at 32.5%. The changes in the following positions are mainly because the information is now available in the 3D model (Figure 1) in Teamcenter-Web and no longer in the 2D drawings from SAP. This optimization can lead to significant savings and increased efficiency. The investments in the first year are CHF 84,000. After that, the company will face annual costs of around CHF 3,000. As the hardware has to be replaced after seven years, the investment then amounts to a further CHF 21,000 in addition to the annual costs. After an amortization period of only 2.3 years, CHF 136,000 can be saved annually.

Recommendations

The next step is to analyze the positioning of the hardware in production, which is essential for ergonomics at the workplace and therefore for an efficient way of working. In addition, it must be determined how the viewer interface makes the most sense for each employee. Fritz Studer AG is also recommended to start with a step-by-step implementation. Cubic production is recommended for this, as the workpieces produced today are already CAM-programmed.

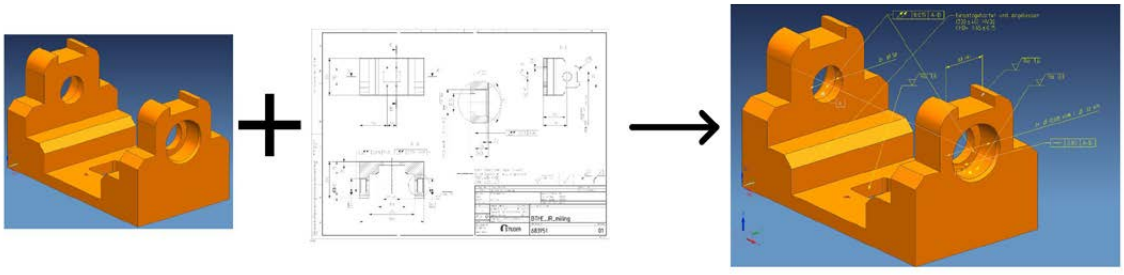


Figure 1: Picture of the as-is-state (drawing-based) to the target-state (model-based)

Production analysis and optimization at Strähl Décolletage AG

Degree programme: BSc in Industrial Engineering and Management Science
Thesis advisor: Patrik Marti
Expert: Prof. Dr. Jörg Grimm
Industrial partner: Strähl Décolletage AG, Leuzigen

In the manufacturing company Strähl Décolletage AG which lacks standardized processes and KPI tracking, there is significant scope for adopting tools that boost continuous improvement and morale. By leveraging industry literature, employee interviews, and best practices from similar companies, traceability and efficiency was enhanced.

Introduction

Strähl Décolletage AG is a manufacturing company engaged with activities including production, logistics, quality assurance, and administration. At the heart of its operations, the company specializes in using CNC machines to produce parts for a diverse range of customers. They are capable of handling orders of any size, ranging from single pieces to large-scale productions of up to one million units. The project addresses issues in quality management and continuous improvement over time.

Research Design

The project began by developing a comprehensive process overview using Business Process Model and Notation, which established a solid foundation for informed decision-making and operational improvement. To gain strategic insights, I conducted semi-structured interviews with CNC mechanics, utilizing the qualitative content analysis to extract crucial perspectives and priorities. The next step involved pinpointing essential Key Performance Indicators (KPIs) to guide the implementation of shop floor meetings. By integrating findings from the interviews and relevant literature, we identified three key KPIs. Concurrently, we delved into motivational factors to better understand and boost morale within the manufacturing setting. Further stages of the project included executing a Process Failure Mode and Effect Analysis (FMEA) with collaborative efforts from representatives across various departments. This analysis identified potential weaknesses in the standard order process and recommended strategies to alleviate risks and eliminate bottlenecks. Documented as a dynamic resource, the FMEA serves as a tool for ongoing enhancement and risk management.

Results

The key metrics of scrap parts percentage, on-time delivery of goods, and machine uptime were identified through statistical analysis as critical for measuring both quality and efficiency, aligning with our strategy for operational improvement. I also pinpointed factors that affect employee morale, leading to the forthcoming launch of the „smart cost idea“ initiative. This program encourages employees to actively engage in ongoing process enhancements, acknowledging their vital role in the company's success. As a reward, they receive a 2% bonus from the annual cost savings generated by their improvements.
In the FMEA analysis, I focused on the three processes most susceptible to failure, successfully lowering their Risk Priority Numbers (RPN) through targeted actions established by our core team. Moving forward, we will continually update this document to ensure a thorough examination of our entire process, from receiving orders to dispatching them to customers, thereby fostering sustained improvement and efficiency.

Future steps

The three key performance indicators (KPIs) identified from the interviews will be displayed on a dashboard for use in regular shop floor meetings with the CNC mechanics. By reviewing these critical production metrics, the team can pinpoint specific areas for process enhancement, thereby boosting overall company efficiency. Additionally, the dashboard will highlight the processes with the three highest Risk Priority Numbers (RPNs), facilitating team discussions on potential improvements.

Ferdi Saiti
saiti_ferdi@hotmail.com
Business Engineering

Data-Driven Valuation of Football Players Using Machine Learning Algorithms

Degree programme: BSc in Industrial Engineering and Management Science
Thesis advisor: Prof. Dr. Jörg Grimm
Expert: Tim Luginbühl
Industrial partner: Berner Fachhochschule BFH, Biel/Bienne

The competitive landscape of the football industry often leads clubs to prioritize sporting success over economic viability, resulting in financial strain. On-field shortcomings are often quickly addressed with new transfers, leading to potential losses and inability to invest enough for the next transfer period. Using machine learning models to determine the optimal timing for player transfer will be crucial, as this timing significantly impacts the club's financial health.

Vakeesan Thayaladevan
Business Engineering

Introduction and Objectives

Football clubs must integrate economic concepts into player transfer decisions to maintain finances in a healthy, sustainable manner. The TCO Model (Total Cost of Ownership, Fig. 2) is an ideal approach, treating players as club assets impacted by lifecycle factors. However, a key limitation in football is forecasting players' remaining market value to operationalize TCO. This study identifies factors influencing player market estimation and integrates them into machine learning models for TCO framework implementation.

Research Design

To forecast the market value of football players, data to train and test the model was collected through web crawling, following theoretical background research to identify influential variables such as performance metrics (from match reports on FBREF.com), player age, position, and injury susceptibility (from Transfermarkt). A Random Forest Regressor was used to forecast the market value of football players within different groups like keeper, defender, midfielder, and forward, which were additionally divided according to their respective ages. Top features for each cluster were identified to gain insights into which metrics to look out for to reliably predict the market value of a given player.

Results

The performance of the random forest regressor (Fig. 1), measured by RMSE (Root Mean Square Error) and MAPE (Mean Absolute Percentage Error), indicates that it generally performs well, with lower RMSE values suggesting better accuracy in predicting market values for specific groups like aging defenders (RMSE = 0.98) and midfielders (RMSE = 1.68). However, the model struggles with younger and prime forwards, as evidenced by higher RMSE values (14.4 and 6.04, respectively) and corresponding high MAPE values. For instance, predictions for young forwards must be considered within an approximate range of ±14.4 million euros around the predicted value or 80% deviation from the actual values. Age, minutes played, and different passing metrics have emerged as top features.

Implications and Recommendations

Based on the model results, the model can predict the market value of the football players by working with different performance metrics, injury susceptibility and player age itself. But to reduce the error margins in the market value forecast especially for the younger players, it is recommended to implement the status- and popularity variables of the respective players for the training phase of the model. Since the model tries to approximate the market value prediction with the values from Transfermarkt, it is necessary to cover those two groups of features as well to increase the forecast accuracy.

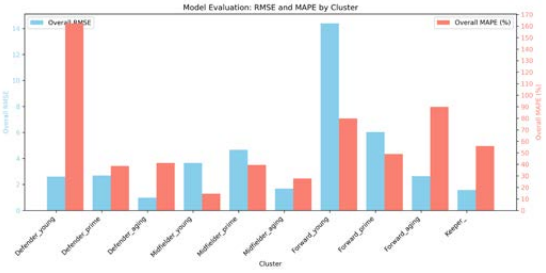


Figure 1: Forecast accuracy regarding the overal RMSE and MAPE of each cluster

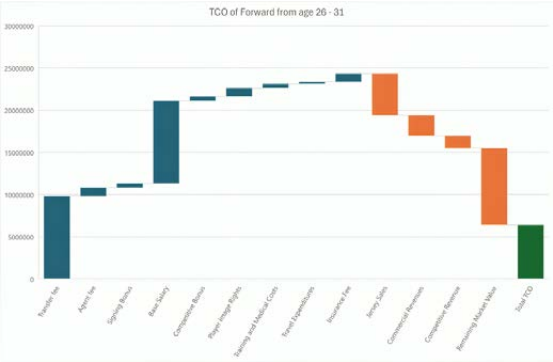


Figure 2: Use Case of the implementation of model forecasts in the TCO concept

Prozessoptimierung und Ermittlung von Kennzahlen in der Elektronikfertigung der Teltronic AG

Studiengang: BSc in Wirtschaftsingenieurwesen
Betreuer: Prof. Dr. Jörg Grimm
Experte: Moritz Maier
Industriepartner: Teltronic AG, Biberist

Moderne Produktionsbetriebe generieren grosse Datenmengen, die oft ungenutzt bleiben. Für eine kontinuierliche Prozessverbesserung und -optimierung sind Prozessmanagement, Standardisierung, Dokumentation, Datenanalyse und Kennzahlen entscheidend. Klare Kommunikation sowie Agilität und Flexibilität sind ebenfalls notwendig. Aus den Prozessdaten sollten Kennzahlen definiert, visualisiert und genutzt werden, um den kontinuierlichen Verbesserungsprozess zu unterstützen.

Einleitung und Zielsetzung

Die Teltronic AG, ein Schweizer Hersteller industrieller Elektronik, betreibt zwei Leiterplatten-Bestückungslinien im Zwei-Schicht-Betrieb. Trotz vorhandener, aber veralteter Dokumentationen gab es in der SMD-Abteilung (Surface Mounted Device) keine geeigneten Kennzahlen oder statistische Auswertungen zur Leistungsmessung. Dies führte zu Unsicherheit bei den Mitarbeitenden und unzureichender Steuerung durch das Management. Ziel dieser Bachelorarbeit ist es, ein umfassendes Kennzahlensystem zu entwickeln, dass die Leistung der SMD-Abteilung transparent und messbar macht. Ein Dashboard soll hierbei unterstützen, um die Prozessleistung zu steuern und die Motivation der Mitarbeitenden zu steigern.

Methoden

In dieser Abschlussarbeit wurden qualitative Forschungsmethoden angewendet. Zunächst wurde eine IST-Aufnahme des SMD-Prozesses gemacht und mittels Business Process Modeling Notation dokumentiert. Diese Dokumentation diente als Grundlage für eine Fehlermöglichkeits- und -Einflussanalyse (FMEA), welche kritische Aspekte und mögliche Verbesserungen des SMD-Prozesses aufzeigte. Es wurden fünf Interviews mit SMD-Mitarbeitern und einem externen Experten durchgeführt, um praxisnahe Informationen über Kennzahlen in der Elektronikindustrie zu sammeln. Ergänzend wurden ERP-Daten der Teltronic AG bestimmt, die zur Erstellung eines Dashboards zur Leistungsmessung dienten.

Ergebnisse

Die Interviewergebnisse verdeutlichen, dass Kennzahlen benötigt werden, um die offene Kommunikation in der Abteilung zu gewährleisten und die Mitarbeitenden über ihre Leistung bezüglich Maschinenauslastung und Qualität zu informieren. Relevante Kennzahlen wie Verfügbarkeit, Bestückleistung, produzierte Menge und Fehlerrate wurden identifiziert. Die Kennzahl Overall Equipment Effectiveness (OEE) fasst diese zusammen und soll auf Linienebene diskutiert werden. Zusätzlich wurden Kenngrössen wie Produktionszeit, Stückzahl und weitere ERP-Daten in ein interaktives PowerBi-Dashboard integriert, um datenbasierte Entscheidungen zu ermöglichen. Ein Optimierungsplan für den SMD-Prozess resultierte aus der Prozess-FMEA.

Implikationen und Empfehlungen

Durch die Einführung des Dashboards können bisher unbekannte Probleme offengelegt werden. Der Firma Teltronic wird empfohlen, das Dashboard wöchentlich durch den Abteilungsleiter auswerten zu lassen, um die Basis für kontinuierliche Verbesserungen sowie Transparenz zur Leistung der Abteilung zu gewährleisten. Zusätzlich soll das OEE-Dashboard auf Linienebene implementiert und mit dem Team regelmässig besprochen werden. Eine weitere Empfehlung ist es, die Prozess-FMEA mindestens jährlich oder bei Änderungen in der Abteilung zu prüfen und neu zu bewertet, um Risiken frühzeitig zu erkennen und geeignete Massnahmen zu ergreifen.

Prianthan Thiyagarajah
Business Engineering

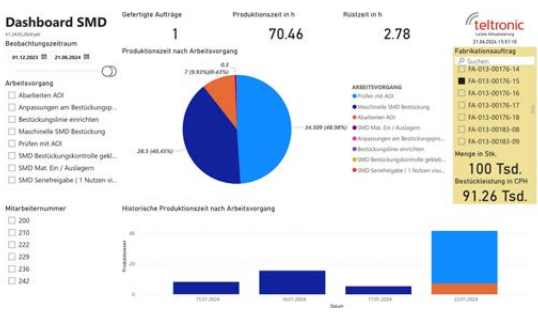


Abbildung 1: ERP Daten Dashboard Teltronic AG

Abbildung 2: Mock-Up Dashboard OEE Teltronic SMD

Supply Chain and Process Engineering

Powering the Future: Charging Infrastructure to Enable the Fleet Electrification of Swiss Post

Degree programme: BSc in Industrial Engineering and Management Science
Thesis advisor: Prof. Dr. Jörg Grimm
Expert: Dr. Maria Franco Mosquera
Industrial partner: Swiss Post, Dintikon

Swiss post wants to reduce greenhouse gas emissions, by electrifying the vehicle fleet in the logistics hub in Dintikon AG. The main challenge is to build charging infrastructure, which can sustain an electric fleet all year and is still economically viable. A combination of solar energy and fast charging stations might be the solution. In conclusion, an electric fleet is likely to be financially worthwhile even without government incentives.

Luca Dominic Hänni

Supply Chain and Process Engineering

Introduction and Objectives

Swiss Post has ambitious climate targets and wants to be climate-neutral by 2040. To achieve this, the fleet of 150 vehicles in Dintikon is to be electrified, among other things. This requires the construction of an electric charging infrastructure at the Dintikon site. The aim of this study is to assess the necessary measures and the costs for such a project.

Research Design

In the pre-study the problems associated with the electrification of vehicles and the construction of infrastructure were identified through a literature review and expert interviews. The bachelor thesis focuses on data collection and evaluation. The data originated either from Swiss Post, literature, vehicle and infrastructure offers and further expert interviews. The data was used to determine the extent of infrastructure requirements and what costs are incurred when installing charging stations, photovoltaic (PV) and battery storage. A base scenario with data for 2024 and three scenarios with predictions for the year 2030 were created.

Results

The full electrification of 150 vehicles results in a high energy demand of up to 50 MWh per working day. The vehicles and the building together require up to 4 MW of power at peak times in winter, since electric vehicles consume more energy with cold temperatures. With complete coverage of the roof with solar modules, more power is produced during the midday than is consumed by the building. The vehicles are all on the road at this time. The calculated load profile of vehicles and solar energy production is shown in figure 1. Estimated investment costs for the project are almost CHF 11 millions. Part of this can be saved through lower energy prices for electricity compared to diesel and incentives, but some of the subsidies for electric vehicles will be discontinued after 2030. Operating an electric fleet will be 12% cheaper until 2030. After 2030, the annual costs for an electric or diesel fleet will reach parity. Table 1 summarizes the estimated total cost of ownership in 2030 of a diesel fleet or electric fleet with 45 charging stations and complete coverage of the warehouse roof with PV modules. A battery storage is not included in any scenario since it can not compensate the cost over the estimated lifetime of 5 years.

Implications and Recommendations

This study shows that the switch to an electric fleet is possible, as the necessary components are available on the market. Even without incentives, an electric fleet can be financially viable in 2030. Still there are risks, like changing energy prices or electricity availability in the future, that could have a negative impact on the costs of an electric fleet, but the same risks apply when continuing with diesel powered trucks.

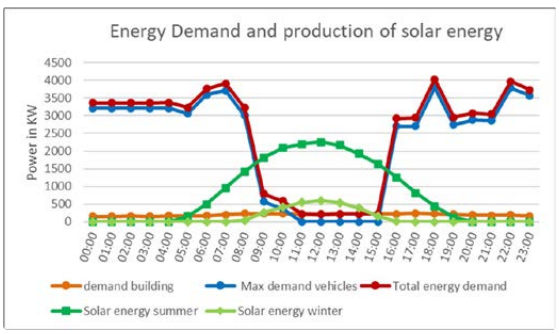


Figure 1: Power demand of the fleet and warehouse compared with solar energy production in summer and winter

TCO 2024				
	All Diesel		All Electric	
Vehicles fixed costs per year	CHF	2'371'000	CHF	4'520'000
Vehicles variable costs per year	CHF	8'252'000	CHF	4'659'000
Infrastructure investment per year	CHF	-	CHF	521'000
Fixed costs grid	CHF	-	CHF	204'000
Savings with solar energy and battery	CHF	-	CHF	571'000
Total costs per year	**CHF**	**10'623'000**	**CHF**	**9'333'000**
TCO 2030				
	All Diesel		All Electric	
Vehicles fixed costs per year	CHF	2'550'000	CHF	3'338'000
Vehicles variable costs per year	CHF	8'268'000	CHF	7'011'000
Infrastructure investement per year	CHF	-	CHF	521'000
Fixed costs grid	CHF	-	CHF	204'000
Savings with solar energy and battery	CHF	-	CHF	571'000
Total costs per year	**CHF**	**10'818'000**	**CHF**	**10'503'000**

Table 1: Total cost of ownership of an electric fleet in 2024 and 2030 compared with a diesel fleet

FAIRwatch: Advancing the development of a sustainable and ethical watch

Degree programme: BSc in Industrial Engineering and Management Science
Thesis advisor: Prof. Dr. Jörg Grimm
Expert: Dr. Maria Franco

The production of watches poses environmental and social challenges, including pollution, deforestation and human rights issues. Growing consumer demand for transparency and responsible practices, especially among the younger generation, is driving the industry's shift towards sustainability. The watch industry bears particular responsibility for the sourcing of raw materials. Consequently, companies need to ensure sustainable supply chain practices.

Introduction and Objectives

The watch industry is Switzerland's third largest export sector and plays a crucial role in the country's economy. But the production of luxury goods, including watches and jewellery, poses significant environmental and social challenges, such as pollution, deforestation and human rights issues. These concerns have increased global demand for transparency and responsible practices throughout the value chain, unsettling the industry. Studies highlight the growing importance of sustainability, driven by consumer expectations, especially among Gen Z and Millennials. With this research, I aim to identify critical sustainability dimensions that must be considered to develop a sustainable and ethical watch; and for which dimensions the watch industry has a particular responsibility or influence in.

Research Design

The thesis employs a qualitative research approach. In the pre-study, a systematic literature review was conducted to assess the current state of academic knowledge on sustainability in the watch and luxury industries. By analysing the frameworks of the Global Reporting Initiative (GRI) and the Sustainable Development Goals (SDG) as well as sustainability reports of watch companies and further research, I derived twelve sustainability dimensions. These dimensions were then analysed in detail. To determine their importance and fulfilment in the watch industry and to obtain a complementary perspective on the topic, seven interviews were conducted with sustainability and industry experts.

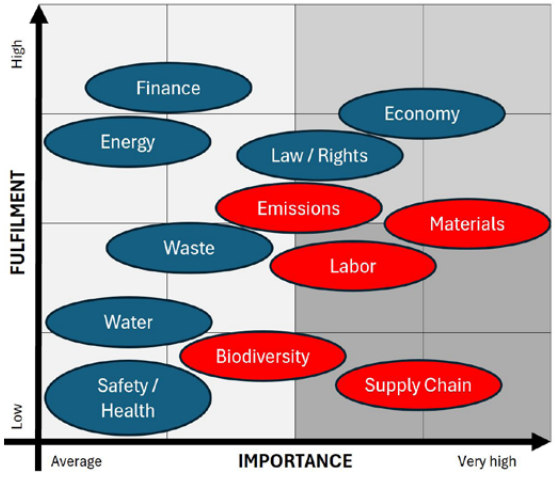


Figure 1: Evaluation of critical sustainability dimensions

Results

The watch industry bears particular responsibility for the sustainability dimensions highlighted in red, as shown in Figure 1. This applies especially to the sourcing of raw materials, where the watch and jewellery industry alone is responsible for 50% of annual global consumption of gold. The extraction of other raw materials and diamonds is also often problematic, leading to deforestation and habitat destruction, as well as critical working conditions and conflict financing. Furthermore, up to 95% of emissions are generated in the supply chain, rather than within the own company boundaries. Consequently, it is of the utmost importance that companies critically analyse and map their supply chains to identify and address sustainability issues. Increasing the use of recycling and alternative, bio-based materials helps to minimise environmental and social risks. The dimensions highlighted in blue are either slightly less important or the degree of fulfilment is already higher.

Implication and Recommendation

My work serves as a guideline for watch companies seeking to become more sustainable. Future research should try to map and analyse the value and supply chain of a watch. Conducting Life Cycle Assessments of the different watches and raw materials help to reveal the impact of emissions. Additionally, exploring ways to promote the circular economy could lead to important findings, by reducing the demand for raw material extraction and advancing the development of sustainable and ethical watches.

Christoph Friedrich Klopfenstein

Supply Chain and Process Engineering

How to Master Data at the Komax Group: A Comprehensive Guide and strategic solution outline

Degree programme: BSc in Industrial Engineering and Management Science
Thesis advisor: Tim Luginbühl
Expert: Prof. Dr. Bastian Widenmayer
Industrial partner: Komax Holding AG, Dierikon

Building on a recent pre-study, this thesis explores the requirements and limitations of the Komax Group concerning a Master Data Management approach. It examines the current approach, identifies prerequisites towards the future approach and offers strategic recommendations. The proposed solution outlines actionable steps to enhance data consistency, governance, and overall management, providing a clear path for effective Master Data Management implementation.

Tom Oehler

Supply Chain and Process Engineering

Introduction and Objectives

The Komax Group, a global leader in wire processing solutions, aims to improve its data quality to optimize operations. This effort is driven by a recent Maturity Assessment that identified several areas needing enhancement in the current Master Data Management (MDM) approach. For Komax, tackling data quality issues is essential to becoming a data-driven company. By addressing these improvement areas, Komax intends to facilitate the integration of newly acquired companies and enable informed decision-making. This thesis will explore the requirements and limitations of Komax's MDM approach and provide a strategic implementation solution.

Research Design

This thesis builds on the findings of a pre-study that identified potential solutions for the main components of a MDM approach. The pre-study was primarily literature-based, supplemented by a small number of qualitative interviews, and offered a general perspective on the topic. In contrast, this thesis focuses specifically on the needs of Komax . It employs qualitative research and reviews internal documents to identify the requirements and limitations of an MDM approach. A workshop with key stakeholders then mapped these requirements to the pre-study findings, resulting in a solution tailored to the organization.

Results

The results of this thesis provide Komax with a detailed and actionable strategic solution outline for implementing an effective MDM framework. The comprehensive overview of MDM requirements and limitations, combined with the theoretical background, equips the organization with the knowledge needed for informed decision-making. Key recommendation include establishing a centralized data repository, defining clear roles and responsibilities, and fostering a culture of continuous improvement and data quality awareness. These recommendations are designed to address the specific needs of Komax (see Figure 1), ensuring that the MDM framework is both practical and scalable.

Implications and Recommendations

There is no one-size-fits-all approach to managing Master Data. Instead, companies must derive suitable solutions tailored to their specific needs from the options available in the literature. This thesis offers recommendations for various areas of the Data Excellence Framework, aligning with the Komax Group's requirements and limitations. However, these proposed solutions need to be further elaborated and customized in detail to ensure successful implementation.

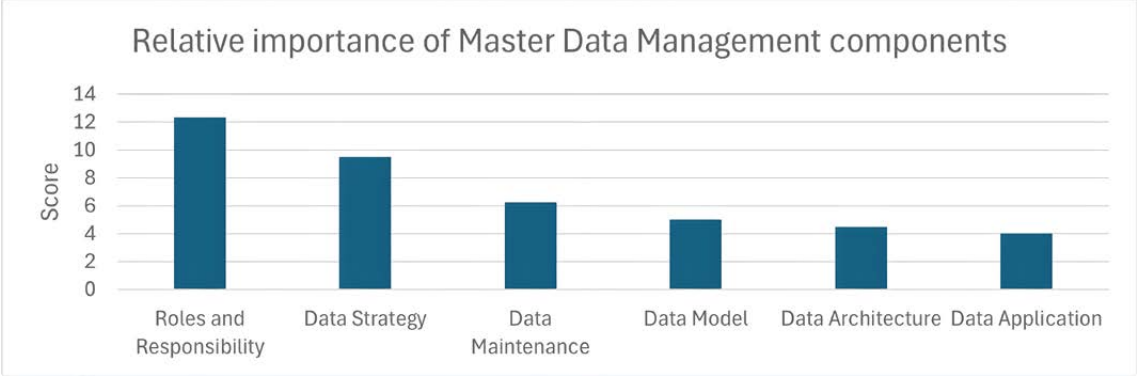


Figure 1 - Relative importance of Master Data Management components for the Komax Group

Industrial Engineering

IoT Monitoring von Überspannungsableiter im SBB Unterwerk

Studiengang: BSc in Wirtschaftsingenieurwesen
Betreuer: Patrik Marti
Experte: Prof. Dr. Cédric Bessire
Industriepartner: SBB CFF FFS, Bern

Überspannungsableiter schützen elektronische Geräte und Systeme in SBB Unterwerken vor Schäden. Es findet heute keine Überwachung der Überspannungsableiter statt. Bei einem Defekt kann es zu Fahrleitungsausfällen kommen, welche den Bahnbetrieb massiv einschränken. Ziel dieser Arbeit ist die Vorbereitung einer mehrjährigen Messkampagne, die neue Erkenntnisse über Überspannungsableiter und deren Zustand liefert.

Nicola Dominic Affolter
nicola_affolter@hotmail.com
Industrial Engineering

Einleitung und Zielsetzung

Die Schweizerischen Bundesbahnen (SBB) planen die Einführung eines IoT-basierten Monitoring-Systems für Überspannungsableiter in den Unterwerken. In den schweizweit verteilten über 70 Unterwerken wird der Strom von 132 kV Hochspannung in 15 kV Fahrleitungsspannung umgewandelt. Diese Ableiter sind entscheidend für den Schutz elektronischer Geräte vor Schäden durch Überspannungen. Ziel dieser Arbeit ist es, mithilfe eines Sensors Überspannungsentladeströme und Leckströme zu messen und zu übermitteln. Durch diese kontinuierliche Überwachung sollen potenzielle Schäden frühzeitig erkannt und Massnahmen zur Verbesserung der Betriebssicherheit und Wartung der SBB Infrastruktur ergriffen werden.

Forschungsdesign

In der Vorstudie wurden die Datenverbindung über LoRaWAN getestet und die Phänomene der Überspannung sowie deren Ursachen recherchiert. Erste Tests mit einem Dummy Sensor und der LoRaWAN-Schnittstelle wurden durchgeführt, um die Machbarkeit des Datenflusses vom Sensor zum Dashboard zu validieren. In der anschliessenden Abschlussarbeit wurden die Datenarchitektur und die Anbindung des Sensors vorgenommen. Das Datenkonzept umfasst die Sammlung, Übertragung, Verarbeitung und Analyse der Daten, unterstützt durch die Plattformen ThingParkX und Azure IoT Hub.

Ergebnisse

Die Ergebnisse zeigen, dass die IoT-basierte Überwachung von Überspannungsableiter die Betriebssicherheit und Wartung der SBB-Infrastruktur erheblich verbessern kann. Die kontinuierliche Überwachung ermöglicht die frühzeitige Erkennung von Anomalien und möglichen Ausfällen. Durch die Verhinderung von Fahrleitungsstörungen mithilfe der gesammelten Daten ist der kommerzielle Nutzen sehr hoch. Die entwickelte Datenarchitektur (Abbildung 1) und die Implementierung eines benutzerfreundlichen Dashboards (Abbildung 2) bieten eine klare und verständliche Darstellung der gesammelten Daten.

Empfehlungen

Die Einführung des IoT-Monitoring-Systems ermöglicht die frühzeitige Erkennung und Vorbeugung von Schäden, optimiert die Wartung, verlängert die Lebensdauer der Überspannungsableiter und unterstützt datengestützte Entscheidungen. Dies führt zu einer Erhöhung der Betriebssicherheit und einer verbesserten Ressourcennutzung. Die gesammelten Daten bieten eine fundierte Basis für die strategische Planung und tragen zu einer nachhaltigeren Infrastruktur bei. Eine Integration in die SBB-IT-Infrastruktur ist notwendig, um eine reibungslose Datenübertragung während der zwei Jahre zu gewährleisten.

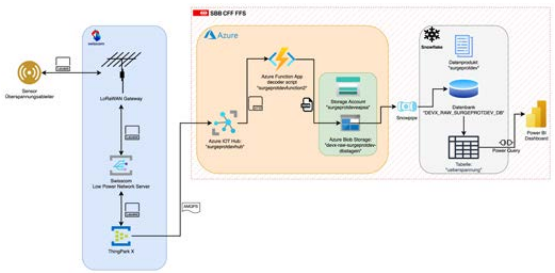


Abbildung 1: Datenarchitektur «Sensor bis Visualisierung»

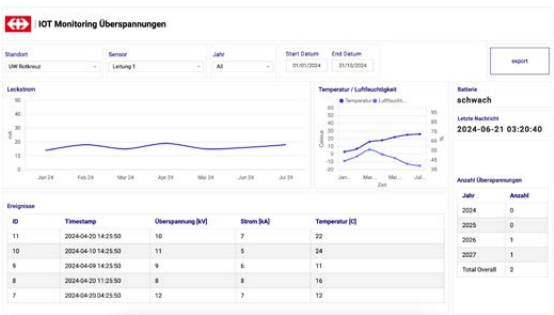


Abbildung 2: IOT Monitoring Dashboard

Increasing Efficiency in the Assembly of Automation Systems: Analysis and Layout Optimization

Degree programme: BSc in Industrial Engineering and Management Science
Thesis advisor: Prof. Dr. Cédric Bessire
Expert: Moritz Maier
Industrial partner: Infotech AG, Solothurn

The company Infotech AG is a leading manufacturer of customized automation cells for various precision industries. The company faces challenges in final machine assembly due to its rapid growth, while continuing to develop and manufacture locally. This thesis analyzes the causes of the current bottlenecks and develops concepts for an optimized assembly layout by examining the various activities that are carried out during the assembly process.

Introduction and Objectives

Infotech AG, a leading provider of automation solutions, is facing challenges in its mechanical final assembly. These challenges result from rapid growth, limited space and a shortage of specialized technicians, leading to both inefficiencies and bottlenecks. The aim of this thesis is to investigate these inefficiencies in order to develop concepts for an optimized assembly process. This would help to increase the efficiency and thus lay the concept to stem more easily the prognosed future growth of produced machines.

Methods

The study started with a detailed analysis of the current situation, including the observation and documentation of existing processes. Interviews were conducted with technicians and department leaders to identify bottlenecks and inefficiencies. Trials were conducted to document the various assembly times and analyze the time spent on different activities during assembly. A literature review provided an overview of different assembly methods. Benchmarking against industry best practices and standards provided a framework for comparison. Improvements focusing on workplace design and layout were then developed and tested in an experimental phase.

Results

The analysis showed several key problems, including inefficient workplace design and long times spent searching for parts and materials. To address these issues, three different concepts for improving the layout were developed. A comparison of these showed that a flow assembly is not implementable at Infotech because of their various products. However, considerable efficiency gains can be achieved with a cycle assembly (see Figure 1) or an optimized fixed-position assembly. These changes minimize walking distances and search times, yielding efficiency gains of around 10% to 27% (see Figure 2).

Recommendations

In order to reduce non-productive times in the final mechanical assembly and to produce a higher number of machines, it is recommended to adapt the layout of the assembly. Changing the production layout that the machine moves forward and employees walk less can minimize non-productive time and improve the overview and efficiency. It is recommended to test a new cycle assembly layout in a pilot project in order to include valuable feedback from the assembly employees who know the processes best before implementation of this more efficient and increased production capacity layout at Infotech AG.

Simon Ambühl
Industrial Engineering

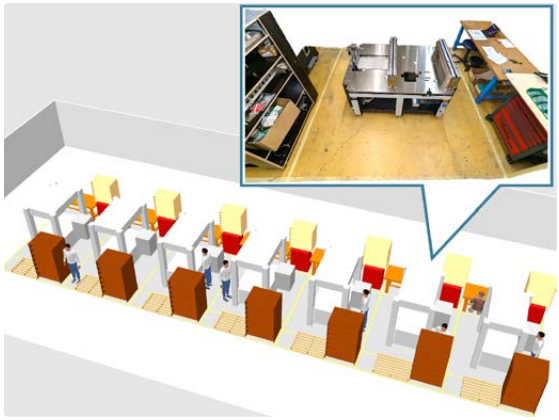


Figure 1: Redesigned layout of Infotech AG's assembly to improve efficiency and reduce movement.

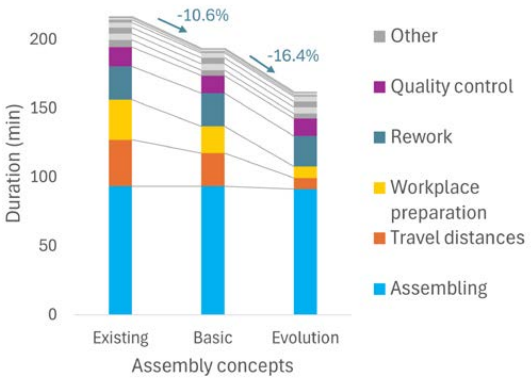


Figure 2: Comparison of current, optimized fixed-position and cycle assembly process and their potential efficiency gains.

Waste valorization in the cocoa/chocolate value chain in Switzerland

Degree programme: BSc in Industrial Engineering and Management Science
Thesis advisor: Dr. Maria Franco Mosquera
Expert: Thomas Blaser
Industrial partner: Bern University of Applied Sciences, Biel

The cocoa pod husks and pulp are wasted on the farms in developing countries, and bean shells discarded in Swiss factories find low-value applications. These byproducts constitute 70 to 80% of the entire cocoa fruit. However, these underutilized materials possess potential for innovative uses. Promoting a circular bioeconomy by valorizing them is becoming crucial to addressing economic, social, and environmental issues in the sustainability of the cocoa value chain.

Juan Blasco Tomás
juanblascotomas@gmail.com
Industrial Engineering

Introduction and Objectives

The global cocoa beans market, with a production of around five million tonnes per year, was valued at CHF 14300 million in 2023 and is projected to grow at an annual rate of over 7%. However, most of the cocoa fruit—the pod husk, pulp, and bean shells (Figure 1)—is still discarded or used for low-value applications. It is imperative to provide immediate support to farmers to enhance their revenue while minimizing environmental impact. Previous studies have investigated various potential applications for cocoa byproducts, including their use as fertilizers, animal feed, biofuels, food, beverages, adsorbents, pharmaceuticals, and cosmetic products. The aim of this thesis is to understand the current state of waste generation and management practices within the cocoa value chain and to identify the challenges that need to be addressed to effectively integrate the valorization of these byproducts.

Research Design

A comprehensive literature review was conducted to examine the structure of the cocoa value chain, market dynamics, sustainability, and byproduct valorization opportunities. Then, a qualitative research approach was employed, involving surveys and ten interviews with chocolate manufacturers, other companies specializing in cocoa byproduct valorization, and industry experts. A qualitative data management software was used for coding and analysis of the interviews.

Results

Although there are already some applications of the pod husk and the bean shell being carried out, the primary byproduct currently being valorized by companies is the pulp, mainly in the food and beverage industry. The main drivers for valorization are sustainability and economic incentives. However, some major challenges include low market awareness and demand, poor infrastructure in farming regions (where many farms lack organization and accessibility), and regulatory hurdles (such as restrictions in the use of cocoa pod husk in the food industry). The cocoa industry is characterized by fragmented value chains, which hinder the integration of circular practices. Big actors in the cocoa industry are too risk-averse to engage in this activity, leaving the initiative mostly to researchers and start-ups.

Implications and Recommendations

The potential for valorizing cocoa byproducts is significant, but there is a need to raise awareness about the existence of cocoa fruit resources beyond the beans and to highlight the benefits of consuming products made from these resources. Major industry players must begin pushing them into the mainstream market. Also, there should be efforts to improve infrastructure in farming regions to facilitate the scaling of valorization initiatives. Productively upcycling cocoa byproducts and integrating them into existing supply chains requires cooperation by all the stakeholders.

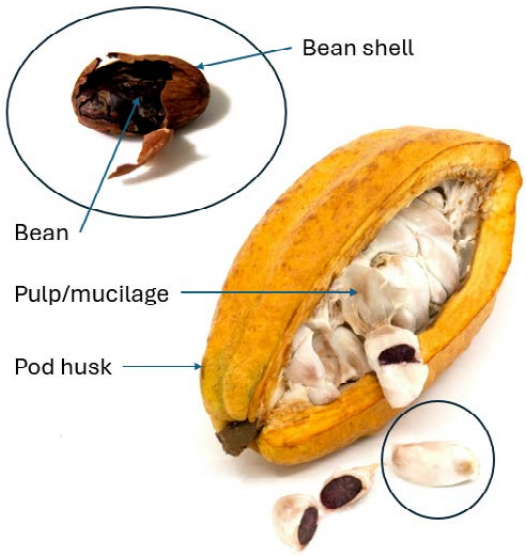


Figure 1: Main parts of the cocoa fruit

Prozessoptimierung und Digitalisierung des Produktionsprozesses und Qualitätsmanagements

Studiengang: BSc in Wirtschaftsingenieurwesen
Betreuer: Patrik Marti
Experte: Moritz Maier
Industriepartner: Aeschlimann AG Décolletages, Lüsslingen

Die Aeschlimann AG Décolletages strebt eine Optimierung ihrer Produktionsprozesse und ihres Qualitätsmanagements an. Manuelle Prozesse und fehlende Datenerfassung beeinträchtigen Effizienz und Qualität. Ziel ist es, diese Prozesse durch Digitalisierung zu verbessern. Im Rahmen dieses Projekts wurden Teile der Prozesse analysiert, Probleme identifiziert und eine Softwarelösung zur Datenerfassung, Effizienzsteigerung und Qualitätsverbesserung evaluiert.

Einleitung und Zielsetzung

Die Aeschlimann AG Décolletages, ein Familienunternehmen in der dritten Generation, steht vor der Herausforderung, die Effizienz und Fehlerfreiheit ihrer Produktionsprozesse und ihres Qualitätsmanagements zu optimieren. Zentrale Probleme liegen in den Abteilungsschnittstellen und einer unzureichenden digitalen Erfassung und Analyse von Prozessdaten. Die Vorstudie zielte darauf ab, Anforderungen und Bedürfnisse zur Steigerung der Effizienz und Qualität zu ermitteln. Die Abschlussarbeit adressierte diese Herausforderungen durch die Digitalisierung der Produktionsprozesse und des Qualitätsmanagements, einschliesslich der Anpassung bestehender Software und der Entwicklung eines kosteneffizienten Prototyps zur Betriebsdatenerfassung.

Methodik

Zur Optimierung der Prozesse wurde eine detaillierte Prozessmodellierung durchgeführt. Die Datenerhebung erfolgte über Dokumentationen im Intranet der Aeschlimann AG Décolletages und qualitativen Fachgesprächen mit Prozessbeteiligten. Anschliessend erfolgte eine Prozess-FMEA zur Identifikation von Fehlerquellen und Risiken. Verschiedene Softwarelösungen wurden untersucht, um geeignete Optionen für die Datenerfassung und Prozessverbesserung zu finden. Dies umfasste eine Analyse der bestehenden Gewatec-Software und deren Erweiterungsmöglichkeiten.

Ergebnisse

Durch die eingesetzte Methodik konnte entsprechend der identifizierten Probleme ein Anforderungskatalog für eine Softwarelösung erstellt werden. Die Ergebnisse zeigen, dass eine modulare Erweiterung der bestehenden Gewatec-Software die Herausforderungen und Ineffizienzen adressieren kann (vgl. Abbildung 1). Dazu gehört die Einführung eines Manufacturing Execution Systems mit Betriebsdaten- und Maschinendatenerfassung sowie weiteren branchenspezifischen Softwaremodulen.

Implikationen und Empfehlungen

Die Digitalisierung des Produktionsprozesses und Qualitätsmanagements ermöglicht es der Aeschlimann AG Décolletages, Effizienz und Qualität zu steigern und Ressourcen besser zu planen. Datengestützte Entscheidungen und Verbesserungen können getroffen werden, wodurch die Reaktionsfähigkeit auf Produktionsprobleme deutlich erhöht wird und eine kontinuierliche Optimierung der Prozesse ermöglicht wird.
Die Untersuchung beschränkte sich auf drei von vier Kernprozessen und schloss Produktionsplanung und -steuerung sowie mehrere unterstützende Prozesse aus. In einer nächsten Phase sollen diese Prozesse ebenfalls untersucht und, analog zum Vorgehen in dieser Abschlussarbeit, eine geeignete Digitalisierungslösung evaluiert werden.

Jerome Galli
j.galli95@bluewin.ch
Industrial Engineering

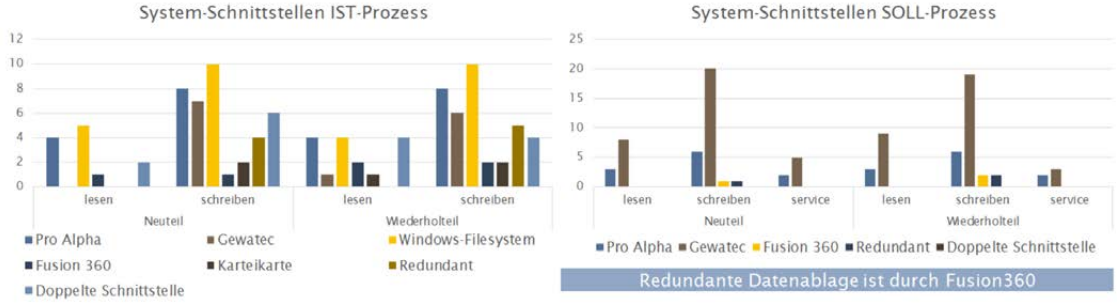


Abbildung 1: Quantitative System-Schnittstellenanalyse

Streamlining the Post-Processing of Customised Additively Manufactured Components

Degree programme: BSc in Industrial Engineering and Management Science
Thesis advisor: Prof. Dr. Cédric Bessire
Expert: Patrik Marti
Industrial partner: Swiss m4m Center, Bettlach

Additive Manufacturing (AM) is still hampered in many high-standard industries by suitable post-processes. Different post-processing methods are compared on a CoCr medical component that meets the metallurgical surface standards. A novel plasma-electrolytic polishing method is identified as the most promising in terms of surface quality, process costs, and environmental friendliness. By automating this process, this technique has enormous potential.

Introduction and Objective

Despite the successes of additive manufactured (AM) metals, the post-processing, essential for achieving the necessary surface quality and geometrical precision, hampers the use of this technology in hightech industries. This project investigates current and future processes and their combinations on their cost and automation potential. One future technology was particularly in focus because of its potential to use it as a single process after the heat-treatment of the fresly printed metal parts. This plasma-electrolytic jetpolishing (PEP-Jet) technology was used as a proof-of-concept on a CoCr-medical component to compare its cost and surface finishing capabilities with current technologies.

Methods

A mixed method strategy was used, starting with literature review, interviews, and observations to compare polishing methods and their various applications. Quantitative analysis included costs, treatment duration, and surface quality. Experimental work involved programming 3D-computer aided design (CAD) models, generating precise polishing paths, and loading them onto a 6-axis robot for jet polishing, followed by detailed surface analysis to comprehensively compare current post-processing methods.

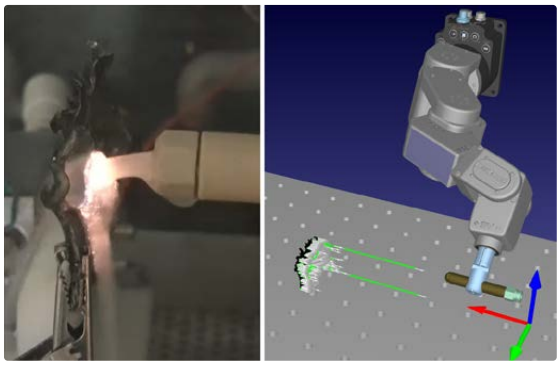


Fig1: PEP-Jet processing a dental prosthesis (left), Virtual model for programming and simulation of the robot (right)

Results

Tests for automated tracing of 3D contours with a 6-axis robot yielded satisfactory results (see Fig.1). The automated PEP-Jet process showed significant potential both economically and qualitatively, since no other pre-polishing is required for AM CoCr workpieces. Thus, the process ensures high surface quality with low costs due to its high automation. Additionally, the PEP-Jet process is environmentally friendly as it uses no hazardous chemicals. The Return in Investment (ROI) analysis confirmed significant cost savings and improved production efficiency compared to conventional methods. Further parameter optimisation makes it possible to make the process even more efficient.

Recommandations

It is recommended to implement the automated PEP-Jet process for post-processing of CoCr workpieces. Fully integrate the 6-axis robot system for precise polishing of 3D contours. Use existing 3D-CAD models (see Fig.2) and computer aided manufactruing (CAM) software to streamline programming for custom-produced implants (see Fig.2). The development of such an industrial machine based on this proof of concept could interest various industries, offering a scalable solution for efficient, high-quality surface finishing of AM parts in various industries. The development of a software that takes over the tasks of the CAM programme and RoboDK at the same time would be an enormous increase in user-friendliness.

Fig2: 3D-CAD Model of dental prosthesis (left), Additiv manufactured part after twelve PEP-Jet polishing processes (right)

Pascal Hofmann
079 735 60 59
Industrial Engineering

Remote maintenance and services in industrial automation for SMEs

Degree programme: BSc in Industrial Engineering and Management Science
Thesis advisor: Prof. Dr. Bastian Widenmayer
Expert: Patrik Marti
Industrial partner: Actemium Schweiz AG, Ittigen

This project aims to develop a concept with an optimized or new remote maintenance solution and to deliver this as a recommendation to Actemium Switzerland. VPN and WebRTC technologies were considered as possible solutions. The results show that the VPN technology is preferred due to high security requirements and suitability in any use case, while WebRTC only proves to be suitable for limited use cases and inefficient for critical applications.

Bleona Istogu
Industrial Engineering

Introduction and objectives

Actemium Switzerland currently uses a remote maintenance solution that is functional, but has potential for improvement in terms of efficiency, security and cost optimization. The aim of this thesis is to analyze the technological and security requirements and to determine an optimized or new remote maintenance solution and thus recommending a new concept that meets the increasing customer requirements.

Research design

A combination of literature research and qualitative interviews with end customers as well as an exploratory discussion with direct stakeholders from the preliminary bachelor study served to identify the exact requirements to determine an optimized or new remote maintenance solution. It was also helpful to analyze the current process to discover any bottlenecks in the process itself. At the same time, the suitability of WebRTC as an alternative and previously unused technology for remote maintenance in industrial automation was investigated. A concept model (see Figure 1) was created to check the feasibility of the implementation. The potential value was also assessed using a SWOT analysis and underlined with the Technology Acceptance Model.

Results

The results show that the VPN technology remains the preferred solution for critical industrial applications. These applications require to meet high security standards which include access to operating system management, complex network configurations, and data-intensive transmissions. Furthermore, VPN provides the necessary infrastructure to ensure network security, efficiency, encryption, and system integrity. While WebRTC would be an interesting use case for avoiding conflicts between manager for IT and OT, respectively, and it could be used for some aspects of remote maintenance, the effort involved in ensuring adequate data protection and system access would currently place a disproportionate burden on resources. Hence, the development of a new or optimized remote maintenance concept using VPN Technology for Actemium Switzerland remained the main objective of this thesis. Furthermore, the benchmarking of VPN solutions confirmed that pursuing a combination of make and buy is the most convenient approach to achieve standardization and scalability.

Recommendations

Based on the results, it is recommended to continue investing in VPN technologies. Investment should be made in more advanced security protocols, improved network monitoring tools, and regular security audits to ensure the integrity and reliability of the remote maintenance systems. WebRTC could be used as a supplement for certain direct communication tasks within a protected environment or for specific applications that do not require full system access.

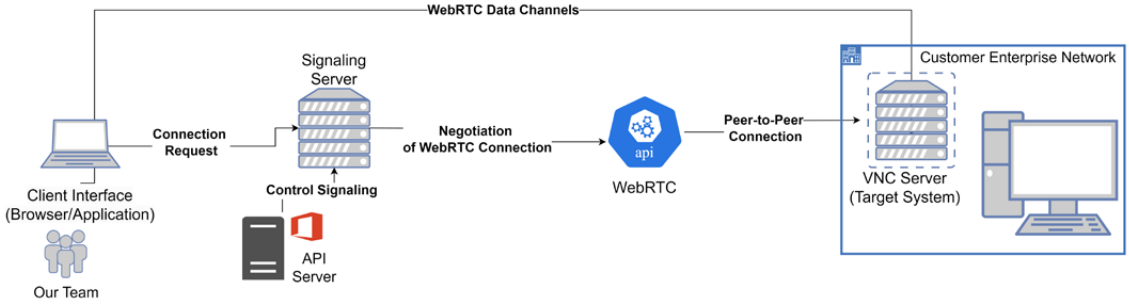


Figure 1: WebRTC Concept for Actemium Schweiz AG

Smart Welding Documentation: Digitalization in Plant Engineering

Degree programme: BSc in Industrial Engineering and Management Science
Thesis advisor: Prof. Dr. Cédric Bessire
Expert: Moritz Maier
Industrial partner: JAG Jakob AG, Brügg

Digitalization of welding documentation in the highly regulated pharma industry is the goal of JAG. Hence, a new paper-less process together with an application using near-field communication (NFC) for user identification of welders, inspectors and project managers has been prototyped and tested in the field on a real project.

Luis Kristian Maurer
Industrial Engineering

Introduction and Context

The traditional management of paper based welding documentation is proving to be inefficient, difficult to control and cost-intensive (see Fig. 1). The aim of this work was therefore to digitise the handling of welding documentation. The focus was on developing a user-orientated application that is easy and reliable in welder's everyday working usage. One of the biggest challenges in requirements engineering was the strong regulation of the pharmaceutical industry, as the system needs to meet FDA and GMP guidelines as well as the needs of the different end users.

Research Design

Based on a comprehensive literature review of the applicable standards, regulations, and guidelines, the legal framework was first defined. Through detailed stakeholder interviews and an extensive analysis of the target and as-is processes, the needs and requirements for the application were developed, and the major sources of errors were identified. This approach was crucial for subsequently developing the prototype application within the correct framework and conducting field tests.

Result

The analysis of the as-is process identified the Weld Log, a paper form with legaly binding signatures for ensuring the quality of the weld seam, as the most complex part of the documentation for digitalisation. A fast login process with a personalised NFC tag, which can also be used for digital signatures as well, proved to be handy for welders. Based on these findings, a prototype application was developed using MS PowerApps. This application enables the login process, user management, the selection and management of projects and welding documents, the digital documentation of welding and inspection processes, and storage in the company's SharePoint. Critical and error-prone data entries of pipe sections (see Fig. 2) can be transferred into the system using Data Matrix codes. Various design reviews based on evaluations of successful open field tests confirmed the developed solution as a proof of concept and a potential of an return on invest up to 41%.

Implications and Recommendations

The developed application proofs the technical feasibility to digitalise the welding documentation process within the legal boundaries. With this prototype the JAG Jakob AG can test the paperless documentation in order to find further improvements for a final implementation, making welder's everyday work easier and more efficient.

Figure 1: Welder at work and Weld Log in paper form with all the welding data and signatures of the welders and inspectors.

Figure 2: Prototype application with NFC tags and Matrix code on a pipe, that will be welded into a pharmaceutical plant.

AI-Powered University Evolution: A path towards the academic future

Degree programme: BSc in Industrial Engineering and Management Science
Thesis advisor: Prof. Dr. Stefan Grösser
Expert: Adrian Stettler
Industrial partner: Bern University of Applied Sciences, Biel

The integration of generative artificial intelligence (genAI) in universities of applied sciences seems to have a great potential, promising new opportunities and benefits for both students and staff. Administration processes and research can be optimized, as well as a significant value can be added to the teaching programs. The questions that have to be answered now are: how to implement this innovative tool and what are the challenges of this integration?

Diego Seco de Herrera Pedrosa
diegoseco02@gmail.com
Industrial Engineering

Introduction and Objectives

With the arrival of the 4th technological revolution, the smart devices and genAI take the lead at the innovation field. Universities are also influenced by these new technologies, and stakeholders claim them to be updated. This thesis aims to create the basis for the integration of genAI in the different aspects of the university, which are administration, research, and academic programs, focusing primarily on the last one. There, different roles for the genAI (Figure 1) in university classes will be demonstrated, providing examples of applications and the value those create for both students and lecturers. It is also the intention to understand the current applications of genAI in universities as well as to obtain the stakeholders opinions, fears, and expectations. Finally, the potential pathways for the future development of this new technology will be set.

Research Design

The first part was the literature review which reviewed existing methods of genAI application and experiments to create a base of knowledge to build on. Then, empirical data was gathered by conducting expert interviews with stakeholders in the university realm, collecting their opinions, expectations, fears, and considerations of the integration of genAI in the academic programs. Additionally, previous experiences, and new ideas and suggestions of the different ways people use genAI in class were collected.

Results

Previous studies have been conducted, indicating various applications of genAI and showing the potential that it has. However, the lack of rigorous experiments points the need for proving the methods proposed. The results of the interviews indicate that the use of genAI is already present in the different aspects of an university, but as a help to the individual tasks of the university staff. It is not yet included in official processes.
In the academic programs, lecturers strive to learn as quickly as possible to provide good content to students and to put them on their main focus. On the other hand, students have seemed to find the perfect individual lecturer, who creates personalized guidance through the content of the modules. However, a general concern about ethical issues is spread over the interviewees.

Implications and Recommendations

Despite all the benefits genAI seems to bring to universities and the willingness of the stakeholders to apply it; the lack of experiments to prove its utility in the existing literature, and the ethical implications, where the limitations are not drawn yet, a framework of uncertainty is created, which does not allow genAI yet to be officially integrated in the university's processes. It will also be a task for the future to raise awareness among the population about the use of genAI and the limits that should be set.

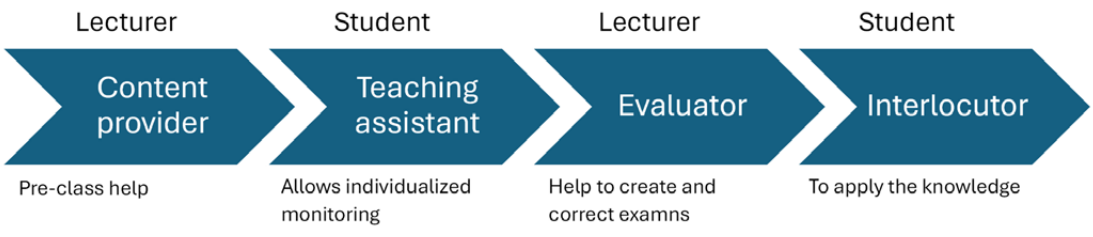


Figure 1: Value chain of the integration of AI in classes, with their roles and respective beneficiaries

Railway Track Laboratory

Degree programme: BSc in Industrial Engineering and Management Science
Thesis advisor: Prof. Dr. Niki Roger Zumbrunnen
Expert: Prof. Dr. Cédric Bessire
Industrial partner: SBB AG, Bern

The SBB plays a crucial role in Switzerland's transportation system, transporting over a million passengers daily. To mitigate railway noise, SBB has installed measurement systems along a specific track section. The aim of this thesis is to analyze how weather conditions, such as temperature, humidity, and air pressure, affect sound propagation and the resulting noise pollution. Building on a pre-study and report, the focus is on systematically analyzing noise peaks.

Introduction and Objectives

The SBB play a crucial role in Switzerland's transportation system, transporting over a million passengers daily. To mitigate railway noise, SBB has installed comprehensive measurement systems along a track section, which is displayed in Figure 1. The aim of this thesis is to analyze how weather conditions such as temperature, humidity, and air pressure affect sound propagation and the resulting noise pollution. Building on a pre-study and report, the focus is on systematically analyzing noise peaks and improving model accuracy through feature engineering techniques. The inclusion of winter data is intended to provide an understanding of the seasonal fluctuations in noise levels, give a comprehensive insight into the effects of weather conditions on railroad noise and provide explanations for the observed noise peaks.

Research Design

The analysis begins with cleansing the data records and checking them for possible errors. Exploratory data analysis (EDA) is then performed using descriptive statistics and visualizations to identify patterns and anomalies. Feature engineering techniques are used to create new variables to improve model performance. Various modeling strategies, including linear regression and random forests, are used to capture both linear and non-linear relationships. The variables used for the linear model were selected using forward selection and lasso. Finally, the results are analyzed to determine the significance of the different factors influencing noise levels.

Results

The environmental factors have only a minimal influence on noise measurements. The model results show that train type, speed and location have the largest influence on the noise level. There are indications that the stream next to the rail could influence the noise levels, as the noise levels vary depending on which side of the track the stream flows. Exactly on every 5th or 6th of the month, the noise rises for inexplicable reasons, as you can see in Figure 2 with the blue lines. The speed-normalized Transit Exposure Level (TEL80) is a measure of noise and was used as the target variable. Despite being speed-normalized, velocity features remain highly dominant. This raises questions about the accuracy of the TEL80 value.

Implications and Recommendations

In a follow-up study, it would be valuable to analyze in detail what exactly happens on the 5th and 6th of each month that causes these noise peaks. It could be something specific to the measurement location or something particular related to rail operations. In addition, some variables that were not considered in this study could be important for feature development and be useful in conjunction with the new stream data.

Tuan Kiet Tran
tuankiet.tran@gmx.ch
Industrial Engineering

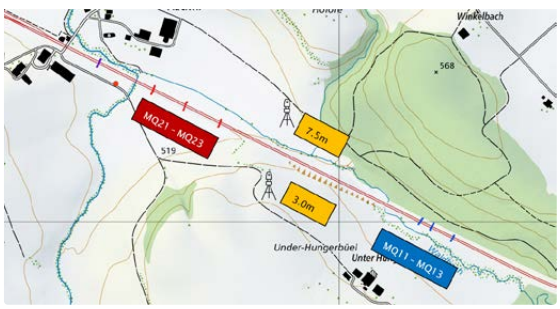


Figure 1: Map of the railway line showing the setup for monitoring stations

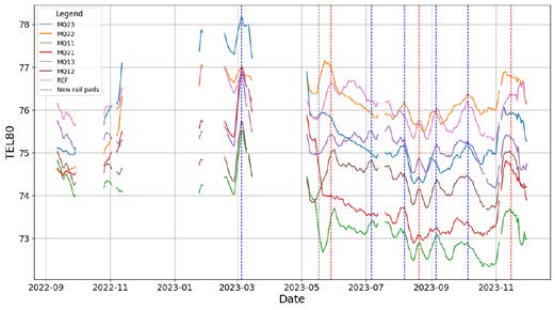


Figure 2: 7-day moving average of TEL80 values per location with marked peak values

From Analog to Digital: An In-Depth Cost Analysis of Dental Prosthesis Manufacturing Techniques

Degree programme: BSc in Industrial Engineering and Management Science
Thesis advisor: Prof. Dr. Bastian Widenmayer
Expert: Prof. Dr. Cédric Bessire
Industrial partner: Swiss m4m Center, Bettlach

Additive manufacturers are creating high-precision dental prostheses using the selective laser melting process and want to move the market from traditional model casting to digitized 3D printing. Although this technology is already a decade old and costs up to a quarter less to produce, additive manufacturers are only taking over less than 10% of the market. This study discusses the economic aspects of both processes and provides a transparent view of the topic.

Simon Tschachtli
Industrial Engineering

State of the Art

The traditional manufacturing process for removable partial dentures (Fig. 1) involves a large number of complicated manual steps that are very time-consuming and therefore expensive. Additive manufacturing overcomes some of these issues with the digitzed creation of the framework and the comparison of accuracy using modern scanners. Although the additive variant has been available for a decade, only less than 10% of prostheses in Switzerland adopt it, and important cost issues are not dealt with publicly.

Methods

This study is based on five case studies. Due to the generalized manufacturing methodology of the Swiss m4m Center in additive manufacturing, it assumes the role of the only digital reference in this work, while a total of four different dental technicians were visited, as the variance in analogue processes is greater. Once a general understanding of the as-is processes was established (Fig. 2), the various cost items such as machine costs, overheads and material costs as well as the times used for each process step could be recorded for each process. Due to different geometries, the products were divided into different complex categories. The aim of this study is to illustrate these differences in economic terms and to create a transparent understanding of the two processes and their associated costs.

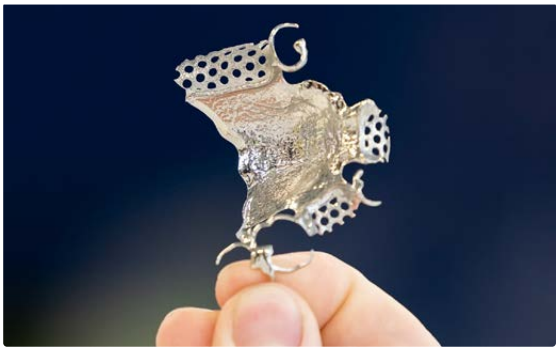


Fig 1: Digitally manufactured dental prosthesis made of cobalt-chrome

Results

By collecting cost data, 60 process steps each and over 280 different cost items were recorded and analyzed. An Excel tool was created to document labor times and all necessary cost items to calculate the manufacturing costs with variables for each process. Manual labor time is the biggest cost factor for both manufacturing techniques and uses around 2.05h for additive manufacturing, while that of the analog method takes 3.2 hours on average. The machine time of additive manufacturing is more than 50% higher than analog manufacturing. The manufacturing costs of additive manufacturing are 7% lower for individual production and around 25% lower for the current capacity utilization of Swiss m4m. At 13%, differences in geometry have less of an impact on manufacturing costs in additive manufacturing than in analog manufacturing, where they average 19%.

Future Research

This study has primarily focused on the economic aspects of dental prosthesis manufacturing techniques. An important factor that remains to be explored is the quality of the prostheses produced by each method, which could be addressed in a further study. The same applies to the topic of designing the prosthesis in-house in additive manufacturing, which is currently designed off-site.

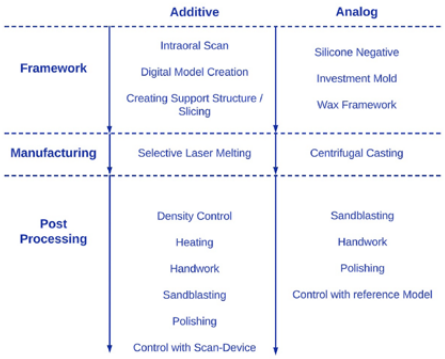


Fig 2: Process differences between digital and analog workflow

Infoveranstaltungen
Séances d'information
Information events

Interessiert Sie ein Studium an der Berner Fachhochschule?

Wir öffnen unsere Türen: Erfahren Sie alles über unsere Bachelor- und Master-Studiengänge, die Berufsperspektiven, die Zulassungs- und Studienbedingungen sowie Wissenswertes über unsere Hochschule. Führen Sie persönliche Gespräche mit Studierenden und Dozierenden und besuchen Sie unsere Labors in Biel und Burgdorf. Mit einer Weiterbildung auf Master-Stufe gehen Sie in Ihrer Karriere einen Schritt weiter. Unsere umfassende, interdisziplinäre Palette von Modulen ermöglicht Ihnen, Ihre Kompetenzen auf verschiedensten Gebieten zu erweitern und zu ergänzen. Informieren Sie sich in einem persönlichen Beratungsgespräch.

Jetzt informieren und anmelden:
bfh.ch/ti/infoveranstaltungen

Vous intéressez-vous à des études à la Haute école spécialisée bernoise ?

Nous vous ouvrons nos portes : obtenez des informations exhaustives sur nos filières de bachelor et de master, les perspectives de carrière, les conditions d'admission et d'études, ainsi que des renseignements précieux sur notre haute école. Discutez avec des étudiant-e-s et des enseignant-e-s et visitez nos laboratoires à Bienne et à Berthoud. Avec des études de master, vous posez un nouveau jalon dans votre carrière. Notre vaste gamme de modules dans diverses disciplines vous permet d'étendre vos compétences dans les domaines les plus variés. Informez-vous dans le cadre d'un entretien de conseil personnel.

Informations et inscription :
bfh.ch/ti/seances-information

Are you interested in studying at Bern University of Applied Sciences?

If so, we invite you to attend our open house events. They will give you insights into our bachelor's and master's degree programmes, career prospects, entrance requirements and study regulations, and provide you with valuable information about our university. You will have the opportunity to talk with students and professors and to visit our laboratories in Biel and Burgdorf. Completing your continuing education with a master's degree takes your career one step further. Our comprehensive, interdisciplinary range of modules allows you to expand and complement your skills in a wide variety of areas. Find out more in a personal counselling interview.

Further information and link to register:
bfh.ch/ti/information-events

Alumni*ae Wirtschaftsingenieurwesen
Alumni en Ingénierie de gestion
Alumni in Industrial Engineering

Studienabgänger*innen des Bachelors in Wirtschaftsingenieurwesen besitzen nicht nur beste Berufsaussichten, sondern sind auch Teil einer national gut vernetzten Community. So können Sie stets auf die richtigen Kontakte zurückgreifen, vom Peer-Austausch profitieren oder neue wertvolle Kontakte knüpfen, um beruflich wie fachlich national und international weiterzukommen.

Sind Sie Absolvent*in und möchten gerne Ihre Erfahrungen aus dem Studienalltag und zum Berufseinstieg weitergeben? Melden Sie sich bei uns: wirtschaftsingenieur@bfh.ch

Interessieren Sie sich für ein Studium in Wirtschaftsingenieurwesen und wünschen sich Informationen aus erster Hand von einem*r unserer Studienabgänger*innen? Vereinbaren Sie jetzt Ihr Online-Gespräch: bfh.ch/wirtschaftsingenieurwesen

Alumni BFH
Alumni BFH vereint die ehemaligen Student*innen sowie die Alumni-Organisationen der BFH unter einem Dach. Als Alumnus oder Alumna sind Sie Teil eines lebendigen Netzwerkes und profitieren von attraktiven Leistungen und Benefits. Sie erhalten regelmässig den Newsletter «Alumni aktuell» und können der Community von Ehemaligen auf Facebook und LinkedIn beitreten und sich so aktiv vernetzen.

Les diplômé-e-s du Bachelor en Ingénierie de gestion jouissent non seulement des meilleures perspectives professionnelles, mais font également partie d'une communauté s'appuyant sur un réseau solide en Suisse. Vous pourrez ainsi toujours compter sur le contact approprié le moment venu, profiter des échanges entre pair-e-s ou nouer de précieux nouveaux contacts pour progresser sur le plan professionnel et technique, tant à l'échelle nationale qu'internationale.

Êtes-vous diplômé-e et souhaitez-vous partager votre expérience de la vie étudiante et des premiers pas dans la vie professionnelle ? Dans ce cas, n'hésitez pas à nous contacter : wirtschaftsingenieur@bfh.ch

Êtes-vous intéressé-e par des études en ingénierie de gestion et souhaitez-vous obtenir des informations de première main de la part d'un-e de nos diplômé-e-s ? Convenez dès maintenant d'un entretien en ligne : bfh.ch/ingenieriedegestion

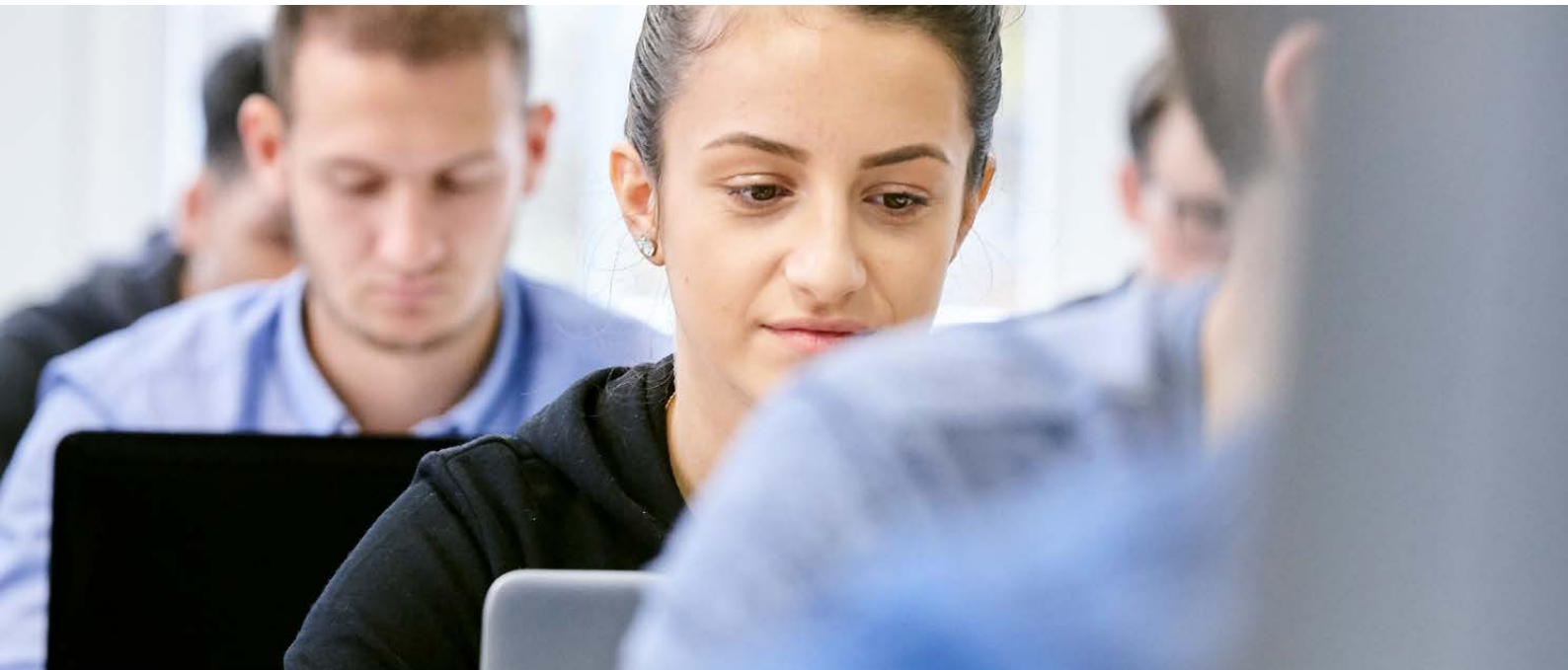
Alumni BFH
Alumni BFH réunit sous un même toit les ancien-ne-s étudiant-e-s et les organisations d'alumni de la BFH. En tant que membre, vous rejoignez un réseau dynamique, profitez de prestations attrayantes, recevez régulièrement l'infolettre « Actualités Alumni » et pouvez échanger activement avec la communauté sur Facebook et LinkedIn et ainsi étoffer votre réseau.

Graduates of the Bachelor in Industrial Engineering have excellent career prospects and are part of a well-connected national community. This allows them to fall back on the right contacts, to benefit from peer exchange or to make new valuable contacts for their professional and technical advancement, both nationally and internationally.

Are you a graduate willing to share your experience of everyday life as a student and of starting a career? Please get in touch with us: wirtschaftsingenieur@bfh.ch

Are you interested in studying industrial engineering and would you like first-hand information from one of our graduates? Arrange your online meeting now: bfh.ch/industrial-engineering

Alumni BFH
Alumni BFH unites former students and BFH alumni organisations under one roof. As a member, you are part of a lively network and benefit from attractive services. You regularly receive the newsletter "Alumni aktuell" and can join the community on Facebook and LinkedIn and thus actively network.



Ihr Mehrwert als Alumni*ae der BFH

Als ehemalige Student*innen sind Sie wichtige Botschafter*innen für die Berner Fachhochschule. Nach Abschluss Ihres Studiums werden Sie (kostenlos) ins fachübergreifende Alumni-Netzwerk des Dachverbands Alumni BFH aufgenommen. Wir bieten Ihnen:

- Newsletter «Alumni aktuell» (4x jährlich)
- Attraktive Angebote und Vergünstigungen
- Vielfältige Veranstaltungen der Alumni-Organisationen
- Alumni-BFH-Community auf LinkedIn und Facebook
- Karriereportal mit Jobplattform und Kursangebote rund ums Thema «Bewerben»

Als Alumni*ae sind Sie exklusiv zum grossen Netzwerk-Abend Alumni BFH eingeladen, welcher jährlich mit über 300 Ehemaligen in Bern stattfindet. Ausserdem können Sie an vielseitigen Events der Alumni-Organisationen und am Sportangebot der Universität Bern teilnehmen. Daneben erhalten Sie Vergünstigungen und Rabatte auf ausgewählte Dienstleistungen und profitieren vom attraktiven FH-Schweiz-Leistungsangebot sowie vom Weiterbildungsangebot der BFH.

Mehr Informationen zu Alumni BFH und den attraktiven Leistungen unter: bfh.ch/alumni

Vos avantages

Nos ancien-ne-s étudiant-e-s sont des ambassadeurs et ambassadrices de choix de la Haute école spécialisée bernoise. Une fois vos études achevées, vous rejoignez (gratuitement) le réseau interdisciplinaire de l'association faitière Alumni BFH et bénéficiez de nombreux avantages :

- Infolettre « Actualités Alumni » (4 fois par an)
- Offres promotionnelles et rabais
- Vaste palette de manifestations proposées par les associations d'alumni
- Alumni BFH Community sur LinkedIn et Facebook
- Portail des carrières avec des offres d'emploi et des cours pour vous aider à postuler

En outre, vous recevez une invitation exclusive à la grande soirée de réseautage qui se tient une fois par année à Berne avec quelque 300 ancien-ne-s étudiant-e-s de la BFH. Vous pouvez également participer aux différents évènements des associations d'alumni et profiter de l'offre sportive de l'Université de Berne. De plus, vous bénéficiez de prix préférentiels et de rabais sur certaines prestations, et avez accès à l'offre de FH Suisse et aux formations continues de la BFH.

Plus d'informations sur Alumni BFH et son offre : bfh.ch/alumni

Your benefits as a BFH alum

As a former student, you are an important ambassador of Bern University of Applied Sciences. After completing your studies, you are admitted (free of charge) in the multidisciplinary umbrella organisation Alumni BFH. Our offer:

- Newsletter "Alumni aktuell" (quarterly)
- Attractive offers and discounts
- A wide range of events set up by the alumni organisations
- The Alumni BFH community on LinkedIn and Facebook
- A career portal with a job platform and courses to help you with your job applications

As an alum, you are exclusively invited to the great Alumni BFH networking night, which takes place annually in Bern with over 300 former students. In addition, you can join the many events set up by the alumni organisations and make use of the sports facilities of the University of Bern. You also receive discounts and special offers on selected services and benefit from the attractive offers of FH Schweiz and from BFH's continuing education programme.

More information on Alumni BFH and its attractive offer: bfh.ch/alumn

Berner Fachhochschule
Wirtschaftsingenieurwesen
Quellgasse 12
2502 Biel

Telefon +41 32 321 64 13

wirtschaftsingenieur@bfh.ch
bfh.ch/wirtschaftsingenieurwesen

Haute école spécialisée bernoise
Ingénierie de gestion
Rue de la Source 12
2502 Bienne

Téléphone +41 32 321 64 13

wirtschaftsingenieur@bfh.ch
bfh.ch/ingenieriedegestion

Bern University of Applied Sciences
Industrial Engineering and Management Science
Quellgasse 12
2502 Biel

Telephone +41 32 321 64 13

wirtschaftsingenieur@bfh.ch
bfh.ch/industrial-engineering