# CIÊNCIAS SOCIALMENTE APLICÁVEIS E HUMANIDADES:

## SABERES, PRÁTICAS E HORIZONTES DE INVESTIGAÇÃO

CAMILO GIRALDO-GIRALDO
(ORGANIZADOR)

EDITORA ARTEMIS
2025

# CIÊNCIAS SOCIALMENTE APLICÁVEIS E HUMANIDADES:

## SABERES, PRÁTICAS E HORIZONTES DE INVESTIGAÇÃO

CAMILO GIRALDO-GIRALDO
(ORGANIZADOR)

EDITORA ARTEMIS
2025

| | |
|---|---|
| **Editora Chefe** | Profª Drª Antonella Carvalho de Oliveira |
| **Editora Executiva** | M.ª Viviane Carvalho Mocellin |
| **Direção de Arte** | M.ª Bruna Bejarano |
| **Diagramação** | Elisangela Abreu |
| **Organizador** | Prof. Dr. Camilo Giraldo-Giraldo |
| **Imagem da Capa** | gropgrop/123RF |
| **Bibliotecário** | Maurício Amormino Júnior – CRB6/2422 |



Editora Artemis
Curitiba-PR Brasil
www.editoraartemis.com.br
e-mail:publicar@editoraartemis.com.br


Editora Artemis
Curitiba-PR Brasil
www.editoraartemis.com.br
e-mail:publicar@editoraartemis.com.br

**Dados Internacionais de Catalogação na Publicação (CIP)**
**(eDOC BRASIL, Belo Horizonte/MG)**

C569 Ciências socialmente aplicáveis e humanidades [livro eletrônico] : saberes, práticas e horizontes de investigação / organização de Camilo Giraldo-Giraldo. – 1. ed. – Curitiba : Editora Artemis, 2025.
il. color.

Formato: PDF
Requisitos de sistema: Adobe Acrobat Reader
Modo de acesso: World Wide Web
Edição bilíngue
Inclui bibliografia
ISBN 978-65-81701-67-3
DOI 10.37572/EdArt_300925673

1. Ciências sociais. 2. Humanidades. 3. Interdisciplinaridade. 4. Pesquisa científica. I. Giraldo-Giraldo, Camilo. II. Título.

CDD 300

**Elaborado por Maurício Amormino Júnior – CRB6/2422**

EDITORA ARTEMIS
2025

Editora Artemis
Curitiba-PR Brasil
www.editoraartemis.com.br
e-mail:publicar@editoraartemis.com.br

## PRÓLOGO

El presente volumen inaugural de la nueva colección ***Ciências Socialmente Aplicáveis e Humanidades: Saberes, Práticas e Horizontes de Investigação*** reúne 25 contribuciones provenientes de universidades y centros de investigación de diversos países. Este primer tomo marca el inicio de una serie concebida para explorar, desde múltiples perspectivas, los desafíos sociales, culturales, tecnológicos y políticos que atraviesan nuestras sociedades contemporáneas.

La diversidad de enfoques, metodologías y contextos nacionales no constituye aquí una dispersión, sino la oportunidad de construir un espacio de convergencia donde la complejidad de lo real se aborda desde perspectivas complementarias. Cada volumen de la colección buscará mantener este espíritu de diálogo interdisciplinar y pluralidad geográfica, configurando una cartografía crítica de los saberes socialmente aplicables y de las humanidades en movimiento.

La organización de los capítulos en este primer número responde a una lógica progresiva que acompaña al lector desde las escalas más amplias de la geopolítica y la gobernanza hasta las expresiones más situadas de los saberes tradicionales y las prácticas locales. Así, el volumen abre con un **primer eje dedicado a la Geopolítica, las Políticas Públicas, la Economía y el Derecho**, en el que se abordan conflictos internacionales, la gestión de recursos públicos, los mecanismos fiscales y judiciales, así como la estructura financiera de las empresas. Se trata de un bloque que ilumina las tensiones entre poder, instituciones y ciudadanía, desde el nivel global hasta el nacional y empresarial.

El **segundo eje, Gestión, Innovación Organizacional y Ingeniería Aplicada**, reúne investigaciones que exploran la gestión de recursos humanos, el liderazgo y la innovación en las organizaciones, las actividades preventivas en los servicios públicos, y estudios de optimización industrial y de sistemas de control. Aquí se articulan las dinámicas organizacionales con las lógicas de la producción y la ingeniería, mostrando la interdependencia entre gestión, innovación y tecnología.

El **tercer eje, Educación, Lenguajes y Tecnologías**, despliega reflexiones y experiencias sobre la autonomía docente en la educación superior, la incorporación de recursos de realidad aumentada y gamificación en la enseñanza, y el valor pedagógico de la tradición oral indígena. Este bloque invita a pensar la educación como un terreno de tensiones entre tradición y modernidad, donde las lenguas, los recursos tecnológicos y la interculturalidad desempeñan un papel decisivo.

El **cuarto eje, Preservación del Patrimonio y Arqueología**, centra la atención en la conservación estructural de monumentos, la gestión de riesgos en paisajes culturales

y la investigación arqueológica de sitios formativos andinos. El patrimonio se presenta aquí no solo como herencia material, sino como un campo de intervención técnica, social y política frente a los desafíos contemporáneos.

A continuación, el **quinto eje, Turismo, Territorio y Sostenibilidad**, plantea interrogantes sobre la movilidad eléctrica en áreas protegidas, las experiencias autoetnográficas del turismo arquitectónico y la función del idioma portugués en la actividad turística en Argentina. El turismo se aborda como práctica social, fenómeno económico y campo de negociación entre conservación, identidad y desarrollo.

El **sexto eje, Cultura, Medios y Diseño**, integra estudios sobre biopolítica y prensa escrita, desigualdades de género en la inteligencia artificial y la historia del diseño comercial en Corea del Norte. Estos trabajos problematizan los modos en que el poder se inscribe en los discursos mediáticos, en los algoritmos y en las formas visuales que modelan la vida cotidiana y la subjetividad.

Finalmente, el **séptimo eje, Salud, Bioética y Derechos Humanos** en diálogo con los Saberes Tradicionales, reúne investigaciones que van desde el conocimiento y uso de plantas medicinales en comunidades afrocolombianas hasta los desafíos bioéticos vinculados con la narcoterapia en Ecuador y las denuncias sobre las denominadas "cárceles electrónicas" y la vulneración de neuroderechos en América Latina. El volumen cierra, así, con un retorno a lo humano y lo local, al tiempo que sitúa en primer plano los debates contemporáneos sobre la dignidad, el cuidado y las éticas de la vida frente a las tensiones entre tradición, tecnología y derechos universales.

En su conjunto, este **primer volumen** ofrece al lector un itinerario que va del análisis de las relaciones internacionales y los marcos institucionales a las experiencias concretas de educación, cultura, turismo y salud. Su riqueza reside no solo en la pluralidad de temas y metodologías, sino también en la posibilidad de leerlos en continuidad, como parte de un proyecto editorial más amplio que seguirá desarrollándose en los próximos tomos de esta colección.

Les deseo a todos una provechosa y enriquecedora lectura.

**Camilo Giraldo-Giraldo**
Universidad de Castilla-La Mancha (UCLM), España

## SUMÁRIO

### GEOPOLÍTICA, POLÍTICAS PÚBLICAS, ECONOMIA E DIREITO

# CAPÍTULO 10

## OPERATIONS OPTIMIZATION FOR THE INDUSTRIAL FAUCET INDUSTRY: TEST ASSEMBLY AND PACKAGING IN A ONE-PIECE FLOW LINE

*Data de submissão: 08/09/2025*
*Data de aceite: 24/09/2025*

**Miguel Terroso**
ID+ Research Institute in Design Media and Culture
School of Design, IPCA
Barcelos – Portugal
https://orcid.org/0000-0001-6486-5335

**Ivo Rodrigues**
ID+ Research Institute in Design Media and Culture
School of Design, IPCA
Barcelos – Portugal
https://orcid.org/0009-0001-3810-8813

**Adriana Amorim**
ID+ Research Institute in Design Media and Culture
School of Design, IPCA
Barcelos – Portugal
https://orcid.org/0009-0009-9433-0599

**Deividi Hartmann**
Superior Institute of Engineering of Porto, ISEP
Porto – Portugal
https://orcid.org/0009-0001-6501-9023

**Maria João Figueiredo**
School of Management, IPCA
Barcelos – Portugal
https://orcid.org/0009-0008-1350-9873

**ABSTRACT:** Customization and the variety of products that the needs of today's consumers demand, represent a great challenge for the faucet industry with just in time products. Some of the companies in Portugal that manufacture and sell faucets still use operations management techniques that do not correspond to these demands of modern industry. In this context, and based on a challenge posed by the company Bruma Europa, the following question was asked: how can we improve performance and reduce assembly, testing and packaging time in the faucet manufacturing process? Bruma Europa is a market leader in the faucet and sanitary accessories industry, having provided quantitative and qualitative data from its current assembly lin. In response to the question posed, an assembly, quality test and packaging line was developed through the application of the one-piece flow line that is easy to assemble, reduces the number of operators and the size occupied on the factory. To validate the optimization, assembly time tests were carried out with the current line and the times compared with the one-piece flow line, obtaining a decrease in assembly time of approximately 47%, guaranteeing an annual optimization of 327 hours.

**KEYWORDS:** industrial operations optimization; faucet industry; one piece flow; ergonomics; production and manufacturing.

## OTIMIZAÇÃO DE OPERAÇÕES PARA A INDÚSTRIA DE TORNEIRAS: TESTE DE MONTAGEM E EMBALAGEM NUMA LINHA DE *ONE-PIECE FLOW*

**RESUMO:** A personalização e a variedade de produtos que as necessidades dos consumidores atuais exigem representam um grande desafio para a indústria de torneiras com produtos *just in time*. Algumas das empresas em Portugal que fabricam e vendem torneiras ainda utilizam técnicas de gestão de operações que não correspondem a estas exigências da indústria moderna. Neste contexto, e com base num desafio lançado pela empresa Bruma Europa, foi colocada a seguinte questão: como podemos melhorar o desempenho e reduzir o tempo de montagem, teste e embalagem no processo de fabrico de torneiras? A Bruma Europa é líder de mercado na indústria de torneiras e acessórios sanitários, tendo fornecido dados quantitativos e qualitativos da sua linha de montagem atual. Em resposta à questão colocada, foi desenvolvida uma linha de montagem, teste de qualidade e embalagem através da aplicação de uma linha *one piece-flow* que é fácil de montar, reduz o número de operadores e o tamanho ocupado na fábrica. Para validar a otimização, foram realizados testes de tempo de montagem com a linha atual e os tempos comparados com a linha *one piece-flow*, obtendo uma diminuição no tempo de montagem de aproximadamente 47%, garantindo uma otimização anual de 327 horas.
**PALAVRAS-CHAVE:** otimização de operações industriais; indústria de torneiras; *one piece flow*; ergonomia; produção e manufatura.

### 1. INTRODUCTION

Operations in a production industry are composed of tasks and decision-making with different levels of planning, programming, optimization, and control. The globalization of markets and industries has fundamentally altered the competitive conditions that companies face. However, the way in which globalization has influenced companies' international diversification strategies is a largely neglected issue in the strategic management of companies and industries (Wiersema & Bowen, 2007). With the expansion of globalization that increases the number of players in global markets and the consequent increase in competition in different industrial sectors, it requires companies to optimize all operations to maintain attractive levels of competitiveness. Because of customization and the diversification of markets and types of products, strategic management emerged as a central research theme (Ramanujam & Varadarajan, 1989) having in many cases an increase in product variation as well as a reduction in the number of units per order.

Considering the number of new products and the variety of products available today, proliferation is visibly evident in several sectors and the faucet and toilet industry is no exception. The literature has identified three main effects of a product proliferation strategy: (1) a broad product line can increase the overall demand faced by the company, (2) a broad product line can affect supply, increasing costs, and (3) a broad product line can have strategic consequences (for example, long product lines can prevent new products

from entering the company (Bayus & Putsis, 1999). Therefore, it is necessary that the next generations of production lines, especially the assembly sections, have a design more adapted to the needs of each industry (Scholz et al., 2016). Modern markets require mass customization, that is, the manufacture of customized products at low cost, such as Tseng et al. defined, mass customization aims to deliver products and services that best meet individual customers' needs with near mass production efficiency (Tseng et al., 2017). Mass customization represents a major challenge for the organization of assembly lines, which were originally designed to manufacture products without major variations. The assembly line for differentiated products is an organizational innovation where several customized products, each associated with an individual customer order and therefore an individual delivery date, are handled simultaneously in a cycle. Consequently, downtime decreases, as well as production costs (Otto & Li, 2020).

Other factors that condition traditional assembly lines are the shorter product life cycles and the increase in product varieties that make production difficult, according to Li et al, 2012, the best that can be done is to manufacture them in one piece flow production systems (Li et al., 2012; Miltenburg, 2001). "One piece flow" production is a technique where everything needed to manufacture is easily accessible and it is not allowed to move on to the next operation without having completed the previous one. The objective of this process is to manufacture the products in the estimated time, without interruptions and without long waiting times. It is the most efficient way of managing human and material resources and its main advantages are: the reduction of order dispatch time; reduction of work in progress; early detection of defects; greater flexibility in the production of customized products; reduced operating costs through exposure/disposal of non-value added waste (Martín & Fernández, 2015; Breyfogle II, 2003).

The sanitary industry, in particular the production of faucets and bathroom accessories, is one of the sectors where competition is fierce and where levels of competitiveness must be high to remain competitive in the market. Bruma Europa Ltd. is an industry present in the market for over 65 years, and synonymous with experience, quality, and innovation in the creation of faucets that balance the aesthetics of their shapes with a high performance in their function. The attention and dedication to the process of creating the faucets reflects the focus and importance that the brand gives to the design of its product and the user experience provided. The production process is increasingly sustainable and combines state-of-the-art industrial techniques with meticulous craftsmanship (Bruma Europa, 2023). However, this company still has some problems in its operations to resolve, especially regarding the type of assembly line, the quality control process of the faucets and during the packaging process.

In this context, we were faced with the question of how can we improve performance and reduce assembly, testing and packaging time in the faucet manufacturing process? The challenge of optimizing production lines using the One-Piece Flow method, aiming to join three production lines (e.g., assembly; quality and compliance testing; and packaging) in a single line, for via of Lean Manufacturing and profitability of some processes. Lean manufacturing is a manufacturing philosophy applied in a wide variety of industries around the world. Its fundamental concept is to provide a quality product and at the same time guarantee the best price for the customer. Today most organizations need to respond to rapidly changing customer needs and to sustain their place in the market, many organizations have started following the concept of lean manufacturing (Gupta & Jain, 2013). This project aims to increase the quantity of production with the reduction of the use of productive resources, less human resources, reduction of the workspace, aiming to reduce stocks and the number/quantity of defective products.

## 2. MATERIALS AND METHODS

The work described here is the result obtained in the 3rd batch of the 2022 edition of the Demola project (Demola Global, 2023). The Demola project consists of a co-creation platform aimed at the academic universe that includes multidisciplinary teams of students and a professor as a facilitator, who together aim to respond to real challenges from different companies through the empirical application of co-creation techniques and much supported by tools typically used by design. The team that developed this project consisted of five elements from different areas, such as industrial design, industrial engineering, and management. The company for which the work was developed, is Bruma Europa, Lda. a company in the sanitary industry responsible for the production and sale of faucets and bathroom accessories.

The methodology used consisted of five stages (Figure 1), starting with a first visit by the team to the company's headquarters where, in a meeting with the production director, the team was explained the challenge that Bruma intended to launch, having as a starting point the assembly, test and packaging line for bathroom mixer faucets (shower and bathtub) and transform this line into a line based on the "one piece flow" concept.

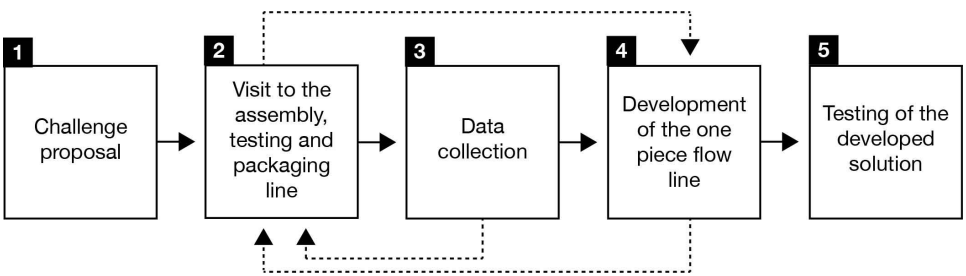
The second stage consisted of a visit by the team to the current assembly, testing and packaging line to observe the current process in loco. Subsequently, in the third stage, the necessary information was collected for a better understanding of the current line, above all qualitative information through non-participating observation of the

assembly, testing and packaging activity, as well as quantitative information regarding the time that each operator takes to carry out the assembly, testing and packaging tasks. This information served to compare with the times achieved with the proposed solution and thus pre-validate the solution.

The fourth stage consisted of the development of the "one piece flow" line for the tasks of assembling, testing, and packaging of the mixer faucets for the bathroom. In this phase, all the models of shower faucets produced by Bruma were identified, as well as the identification of the components and the water inlet and outlet locations for each model. This information was relevant for the design of the assembly line and the post-assembly test of the faucets. During this phase, the team had to visit the existing line again to rectify some of the information together with the line operators, especially component designations, and observation of the current assembly process. The team was divided into three groups, one for the development of the line with the execution of three-dimensional CAD models, another for budgeting the production and implementation of the line and a third for quantifying the current assembly, testing, and packaging times and for later comparison, with the proposed solution. During this phase there was constant iteration with the workers of the current line, and with the production management to validate solutions as the development of the "one piece flow" line was being developed.

The fifth and last phase consisted of testing the proposed line and based on the time required to carry out the operations on the current line, then the time required to carry out the operations of the "one piece flow" line was compared.

Fig. 1. Flow organization chart illustrating the applied method.




## 3. RESULTS

After a visit and some analysis, the team verified that there were some flaws in terms of resource optimization, some waste of the current production lines, reaching the conclusion that the programming of a pneumatic test system will completely automate

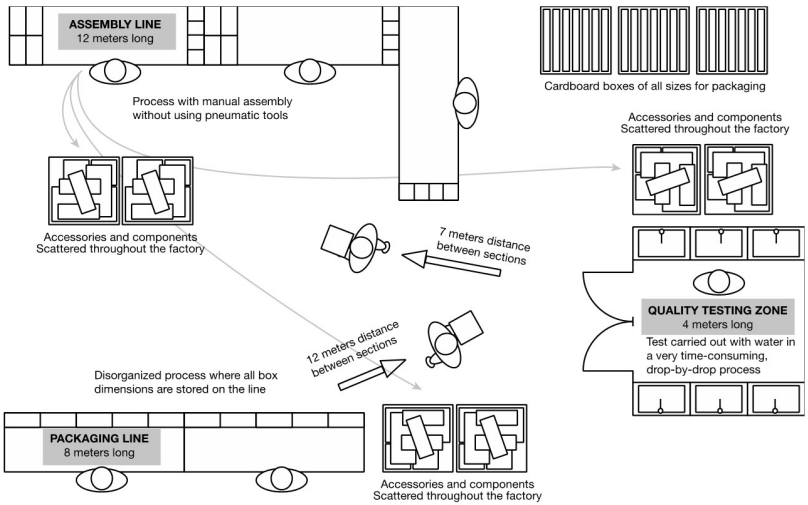
one of the main production processes, thus controlling the number of existing failures. The team, after several meetings and specific analyses, identified that the purchase of tools and the reorganization of the new line will be necessary to reduce production time and prove to be important in terms of waste reduction and in the balance of technique, used from one piece flow.

To obtain significant improvements, the investment in the purchase of tools and material for the development of the lines and all the time spent on making 3D printing templates are some of the ways of planning the manufacturing processes that prove to be sufficient to obtain the significant improvements. From the point of view of some stakeholders, such as Bruma's employees, it was concluded that they feel disorganized, little optimization in workflows, little automated work methods and a lot of weakness of resources. They think that there should be changes to obtain a more organized and efficient future at work, finally, they say that there should be more automatic tools, more adequate assembly methods and more organization and optimization in all production lines.

Figure 2 shows parts of the current assembly and packaging line, where there is no organization per piece to be assembled now, what can be seen is that the line also works as a warehouse for the components that make up each faucet, or of the cardboard boxes themselves. This situation makes the management of time and space more difficult and with unsatisfactory control results. Another negative aspect described by the operations management is the fact that after the faucet was assembled, it was tested to verify that the faucet has no leaks, this test is carried out using water in a drop-by-drop process and in a space that is far from the assembly and packaging line, the test is also carried out by operators. For the current assembly, testing and packaging operation, between 3 to 6 people are required.

We noticed there was some disorganization in terms of line logistics, there were many materials on the floor, low benches in relation to the correct posture that the employee must adopt, to avoid accidents at work and wear and tear diseases, due to the location of the components, we checked unnecessary movements by the line members, which wasted time in the assembly section. There was no fluent logistics in determining the spaces occupied, for example, the lines have large dimensions and, consequently, take up more space than they should occupy, wasting time in assembly.

Fig. 2. Current assembly and packaging line, where the test to ensure the quality of the assembly is not carried out on the line, the current line occupies about twenty meters and the management of components is done on the line itself.




The team, after fully understanding the challenge, both through visits to the company and through data collection, moved on to the design and development phase, a proposal for the one-piece flow line. Using several brainstorming sessions among all team members, a line was designed, as shown in figure 3. A line made up of three sections: the first section made up of the assembly area; the second constituted by the assembly quality test area; and the third constituted by the packaging area. The entire line has a support desk at an ergonomically comfortable height so that employees can perform tasks effectively, reducing injuries from poor posture. In the upper part of the counter there is a support structure for placing the components, necessary for the operation that is being carried out and which in turn are fed from the back through automatic trolleys that receive the information sent by the assembly operator in the start of operation. The line is operated by two persons, one for assembling the faucets and the other for packaging, behind each operator there are waste bins so that operators do not have to leave the line, between each operator there is a trolley with bins for components and faucets that do not pass the quality test. Behind the packaging operator are the pallets for placing the completed parts ready for shipment.

In the middle of the assembly and packaging section is the test and quality control section for possible leaks (Figure 4). This section does not have any highlighted operator, the operation is carried out by the operator who is stopped at the moment of the testing phase, either the assembly one, or the packaging one. This situation means that there is not one or more operators for the quality control function, it allows the operation to be

carried out more quickly and without leaving the line, it also allows the detection of faulty parts more quickly. It is also intended to place time and produced units in monitoring screens, so that it is possible to control the execution time and the quantities reached daily (real production values). These computers would be programmed by an external operator, who creates a detailed and specific set up for a given line.

The entire line is made up of a structure that is easy to assemble and disassemble, using existing aluminium profiles on the market, as well as the respective connecting parts and fixing the profiles. This system allows the line to be robust and light at the same time and allows any employee of the company to be able to assemble it easily.

Fig. 3. Image with the proposed "one piece flow" assembly line, on the left is the assembly section and on the right the packaging section, in the middle is the section for quality testing using compressed air.

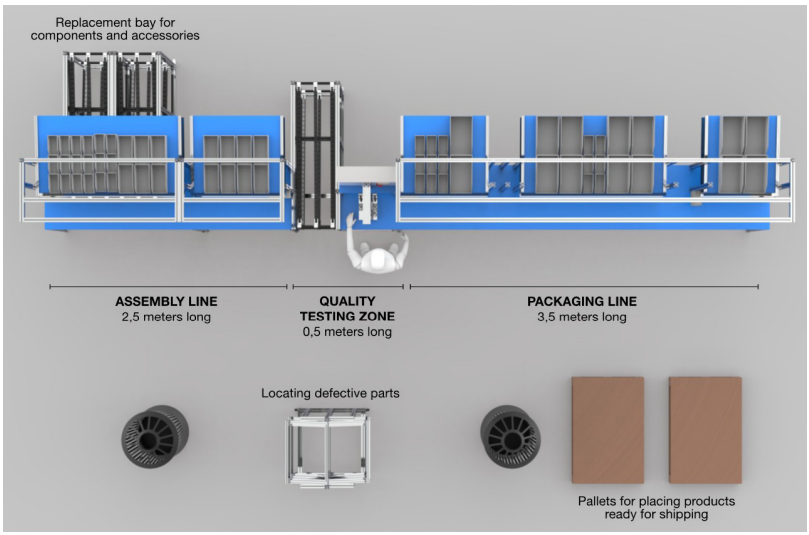
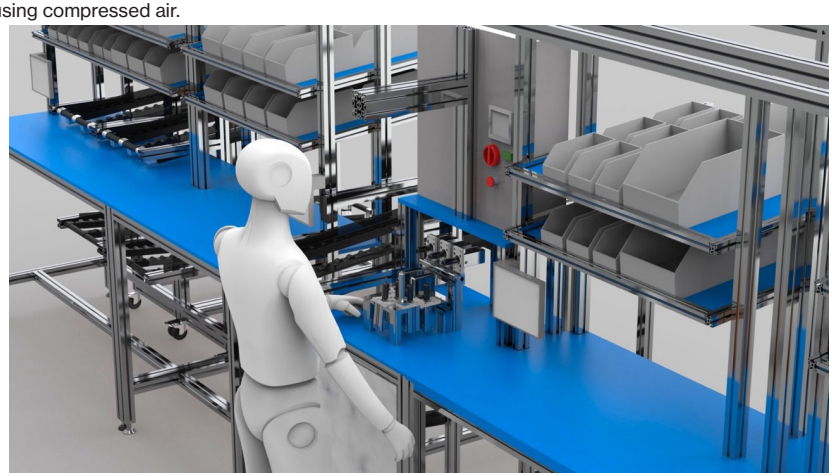


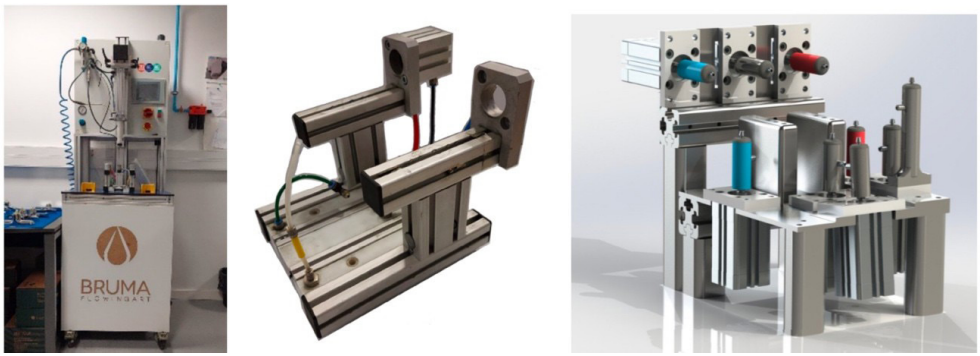

Fig. 4. 3D Image with the proposed "one piece flow" assembly line, in front of the operator is the section for quality testing using compressed air.



The quality control and test section are made up of a bench, where there is a machine powered by compressed air, whose purpose is to inject air with a certain pressure and for a certain time in the different models of faucets, after their assembly, to detect whether the faucet has leaks or not, thus making the quality control of the same.

At the base of the bench there is a template where the taps are placed and where the air inlets and outlets fit. In the existing line, each faucet model needs a gauge to test the faucet, in the proposed one-piece flow line, a gauge was developed (figure 5) capable of carrying out the air test on all models of bathroom faucets, in this case we are talking about five different faucet models. This innovation in the test section is of great value for the line and for the operation itself, as it provides a huge reduction in time, not having to replace the gauge whenever a different faucet model is being assembled on the line.

Fig. 5. The images on the left and in the middle show the machine and the current template for testing with compressed air after assembly, in the image on the right the project of the proposed template where all faucet models can be tested with the same tool.




## 4. DISCUSSION

The proposed one-piece flow line was well received by the company's operations management, having been indicated for production and implementation. The good receptivity of the line was validated by the preliminary test carried out by the team, comparing the assembly, testing, and packaging time of the current line and the time required for the same operations with the proposed line. The results obtained were taken by using the average time for each operation that were carried out in the previous lines, the times of waste in displacements, separation of equipment and setup of tools for tightening were removed in this step, as well as the time in which the test operator it took to complete this process.

The tests were then carried out with all 19 models of mixers, in table 1 we see 2 models exemplified with their due internal references (CRP668001 and CRP6668056), all the necessary ones were planned and the time to execute the operations was described.

Table 1: Average Task Time (Seconds).

| | Op. | Description | CRP6668001 | CRP6668056 |
|---|---|---|---|---|
| ASSEMBLY | 1 | Assembly of the 4 orings on the 2 Bushings | 17 | 17 |
| | 2 | Assembly of the oring in the bushings | 7 | 7 |
| | 3 | A paste to the preassembled bushings orings | 6 | 6 |
| | 4 | Separation of Bathtub Bodies | 2 | 2 |
| | 5 | Threading of the bushings to the body | 20 | 20 |
| | 6 | Spout separation | 3 | - |
| | 7 | Mounting the spout on the spigot (bushing connection) | 4 | - |
| | 8 | m5x6 stud threading | 8 | - |
| | 9 | Cartridge mount on body | 5 | 5 |
| | 10 | Nut assembly on body | 6 | 6 |
| | 11 | Nut tightening (cartridge) | 2 | 2 |
| | 12 | Bell threading | 6 | 6 |
| | 13 | Nut tightening (cartridge) | 2 | 2 |
| | 14 | Inverter handle threading | 4 | 4 |
| | 15 | Aim and thread stud inside handle | 4 | 4 |
| | 16 | Insert handle into body and tighten bolt | 8 | 8 |
| | 17 | Insert handle into body and tighten bolt | 7 | 7 |
| | 18 | Insertion of the finished body into the testing machine | 8 | 8 |
| TEST | 19 | Test | - | - |
| PACKING | 20 | Pick up sausage to be tested and place it on the bench | 9 | 9 |
| | 21 | Perlator threading | 10 | 10 |
| | 22 | Body cleaning with cloth | 30 | 30 |
| | 23 | Insert single lever into bubble bag | 6 | 6 |
| | 24 | Fold and apply sticky tape to the bubble bag | 15 | 15 |
| | 25 | Packaging folding | 9 | 9 |
| | 26 | Single lever housing in the packaging | 5 | 5 |
| | 27 | Housing Eccentric kit in the packaging | 2 | 2 |
| | 28 | Wall bracket housing packaging | 2 | |
| | 29 | Add the shower mesh filter in the bubble bag | 3 | 3 |
| | 30 | Fold and insert the separator into the package | 4 | 4 |
| | 31 | Insert BLG and Certificate inside the box | 5 | 5 |
| | 32 | Apply BRUMA seal | 5 | 5 |
| | 33 | Put box on pallet | 6 | 6 |
| | | Assembly | 119 | 104 |
| | | Test | 0 | 0 |
| | | Packing | 111 | 109 |

When comparing the times, the improvement was easy to see in Table 2, where we compare the old times with the new ones, in a year with the same number of items going through the new line, the company will save approximately 327 hours less production for the same number of items.

Table 2: Average Task Time (Seconds).

| Body Code | Assembly Old | Test Old | Packing Old | Total Old | Assembly New | Test New | Packing New | Total New | Approximate Improvement |
|---|---|---|---|---|---|---|---|---|---|
| CRP6668056 | 61,5 | 29,1 | 73,6 | 164,3 | 43,2 | 0,0 | 45,3 | 88,6 | 46,08% |
| CRP6668018 | 0,0 | 24,5 | 42,9 | 67,4 | 0,0 | 0,0 | 41,8 | 41,8 | 38,07% |
| CRP6668050 | 0,0 | 22,1 | 40,5 | 62,6 | 0,0 | 0,0 | 37,6 | 37,6 | 39,88% |
| CRP6668048 | 0,0 | 14,6 | 47,7 | 62,3 | 0,0 | 0,0 | 31,6 | 31,6 | 49,28% |
| CRP6668001 | 57,6 | 21,7 | 54,4 | 133,7 | 34,4 | 0,0 | 32,1 | 66,6 | 50,22% |
| CRP6668047 | 0,0 | 14,6 | 25,7 | 40,3 | 0,0 | 0,0 | 27,2 | 27,2 | 32,50% |
| CRP6668046 | 0,0 | 11,5 | 21,7 | 33,2 | 0,0 | 0,0 | 20,6 | 20,6 | 38,07% |
| CRP6668049 | 0,0 | 10,7 | 20,4 | 31,1 | 0,0 | 0,0 | 18,9 | 18,9 | 39,18% |
| CRP6668042 | 0,0 | 7,5 | 11,1 | 18,5 | 0,0 | 0,0 | 11,1 | 11,1 | 40,35% |
| CRP6668027 | 0,0 | 5,5 | 11,3 | 16,8 | 0,0 | 0,0 | 10,9 | 10,9 | 35,40% |
| CRP6668051 | 0,0 | 6,6 | 10,4 | 17,0 | 0,0 | 0,0 | 10,6 | 10,6 | 37,65% |
| CRP6668028 | 0,0 | 4,4 | 8,7 | 13,1 | 0,0 | 0,0 | 7,6 | 7,6 | 42,08% |
| CRP6668060 | 9,6 | 5,0 | 12,6 | 27,1 | 7,3 | 0,0 | 7,5 | 14,8 | 45,50% |
| CRP6668054 | 11,0 | 5,0 | 15,5 | 31,4 | 7,9 | 0,0 | 7,4 | 15,3 | 51,16% |
| CRP6668026 | 0,0 | 2,6 | 5,3 | 7,9 | 0,0 | 0,0 | 5,1 | 5,1 | 34,78% |
| CRP6668041 | 0,0 | 2,1 | 4,4 | 6,5 | 0,0 | 0,0 | 4,1 | 4,1 | 36,47% |
| CRP6668022 | 0,0 | 1,4 | 3,2 | 4,7 | 0,0 | 0,0 | 2,6 | 2,6 | 44,90% |
| CRP6668023 | 0,0 | 1,5 | 2,8 | 4,4 | 0,0 | 0,0 | 2,4 | 2,4 | 44,50% |
| CRP6668053 | 2,1 | 0,9 | 2,0 | 5,0 | 1,4 | 0,0 | 1,5 | 2,9 | 40,93% |
| Total | 141,7 | 191,5 | 414,1 | 747,3 | 94,3 | 0,0 | 326,0 | 420,2 | 43,76% |

## 5. CONCLUSION

In short, with regard to the test sector, the team managed to create a gauge, previously identified, capable of testing all the models of faucets that make up 80% of the production of the company Bruma, opting for an effective and sustainable system where we sought replace the water testing of the impediment of the canals, for an air test, thus avoiding the waste of water and seeking to bring to this process some rigorous reality, preserving human resources, which can be reallocated to other functions.

This new production line has ergonomic benches, that is, height-compatible for men and women, so that any properly trained person, regardless of gender, can integrate the line without any type of physical or motor deficit. An effort was also made to implement

duly located pneumatic tools together with screens for monitoring the different times, assembly, testing and packaging, and the number of units produced, with the aim of realizing real production values useful for better management of production quality.

Finally, the balance of the production line was studied, seeking to achieve a balance of times between the different sectors (assembly, testing and packaging).

## 6. ACKNOWLEDGEMENTS

We would like to thank the faucet company Bruma Europa, Lda., especially the operations director Engineer Miguel Ferreira. We also thank the project in innovation and co-creation Demola Global. This work was supported by FCT – Fundação para a Ciência e Tecnologia, I.P. by project reference UID/04057: Research Institute for Design, Media and Culture.

## REFERENCES

A. Martín del Río, L. Fernández Luis (2015). Construcción de un modelo parametrizable de la escuela lean mediante witness: one piece flow. Trabajo Fin de Máster em Logística de la Escuela de Ingenierías Industriales de la Universidade de Valladolid, pp 25-26, http://uvadoc.uva.es/handle/10324/13830

A. Otto, X. Li (2020). Product sequencing in multiple-piece-flow assembly lines. Omega, Vol. 91, March, doi.org/10.1016/j.omega.2019.03.013

B.L. Bayus, W.P. Putsis, Jr (1999). Product Proliferation: An Empirical Analysis of Product Line Determinants and Market Outcomes. Marketing Science, Vol. 18, No. 8, pp. 137-153, May, doi.org/10.1287/mksc.18.2.137

Bruma Europa (2023). Bruma Flowing Art. Bruma. https://www.bruma.pt (retrieved 15 March 2023 Accessed).

Demola Global (2023). Demola Portugal Initiative. Demola. https://portugal.demola.net (retrieved 13 March 2023 Accessed).

F.W. Breyfogle III (2023). Lean Tools That Improve Processes: An Overview. bptrends. https://www.bptrends.com/bpt/wp-content/publicationfiles/FOUR%2003-07ART-LeanToolsThat%20ImproveProcesses-Breyfogle-Final.pdf (retrieved 15 March 2023 Accessed).

S. Gupta, S.K. Jain (2013). A literature review of lean manufacturing. International Journal of Management Science and Engineering Management, Vol. 8, Issue 4, pp. 241-249, August, doi.org/10.1080/17509653.2013.825074

J. Miltenburg (2001). One-piece flow manufacturing on U-shaped production lines: a tutorial. IIE Transactions, Vol. 33, pp 303-321, April, doi.org/10.1023/A:1007642522626

M. Scholz, S. Kolb, C. Kastle, J. Franke (2016). Operation-oriented One-piece-flow Manufacturing: Autonomous and Smart Systems as Enabler for a Full-meshed Production Network. Procedia CIRP, Vol. 57, pp 722-727, doi.org/10.1016/j.procir.2016.11.125

M.F. Wiersema, H.P. Bowen (2007). Corporate diversification: the impact of foreign competition, industry globalization, and product diversification. Strategic Management Journal, Vol. 28, Issue 2, pp. 115-132, October, doi.org/10.1002/smj.653

S.G. Li, Y. Ni, X. Wang, L. Shi and L.J. Zhu (2012). Design of one-piece flow production system with mixed flows: a timed process flow diagram-based approach. Int Journal of Comp. Integrated Manufacturing, Vol. 25, Issue 11, pp 996-1010, May, doi.org/10.1080/0951192X.2012.684709

Tseng, Mitchell M., Yue Wang, Roger J. Jiao (2017). Mass Customization. In: The International Academy for Produ, Laperrière L., Reinhart G. (eds) CIRP Encyclopedia of Production Engineering. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-35950-7_16701-3

V. Ramanujam, P. Varadarajan (1989). Research on corporate diversification: A synthesis. Strategic Management Journal, Vol. 10, Issue 6, pp. 523-551, November/December, doi.org/10.1002/smj.4250100603

## SOBRE O ORGANIZADOR

**Camilo Giraldo-Giraldo** is a Lecturer in Business Organisation at the University of Castilla-La Mancha (UCLM). He holds a Master's degree in Business Strategy and Marketing and is currently in the final year of his PhD in Business Organisation at the same university. His research focuses on Human Resource Management and Organisational Sustainability.

He has been awarded the Research Scholarship of the Santander Chair, granted by Banco Santander in partnership with the University of Castilla-La Mancha. He has also received the recognition for Best Doctoral Thesis in Progress from the European Business Ethics Network (2025).

ORCID: https://orcid.org/0000-0002-4100-3764

## ÍNDICE REMISSIVO

### A



### B



### C



### D

## E



## F



## G



## H



## I

## Q



## R



## S

## T



## U



## V

EDITORA ARTEMIS
2025