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# Empowering Disability Communities through Inclusive Transfemoral Prosthesis Co-Design with a Local SME in Indonesia

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ABSTRACT

**Background**: Lower-limb loss poses significant challenges to mobility, employability, and social participation for many individuals in low- and middle-income countries. In Indonesia, the high cost of imported prosthetics has prompted community-based small enterprises to produce low-cost transfemoral devices.
**Contribution:** This study contributes to support a local prosthetics workshop (Independent Disabled Creativity Foundation/IDCF) by integrating user feedback and basic functional assessments to guide improvements to a transfemoral prosthesis prototype.
**Method:** Seven transfemoral amputees completed the Locomotor Ability Index (LCI), then performed standing, walking, and stair climbing tasks assessed by the Amputee Mobility Predictor with Prosthesis (AMPPRO), Rating of Perceived Discomfort (RPD) questionnaire, and Post-test Interview with improvement concepts using the SCAMPER (Substitute, Combine, Adapt, Modify, Put to Other uses, Eliminate, Rearrange) creativity method.
**Results:** Participants achieved independent ambulation (mean LCI = 51.00 ± 5.10; AMPPRO = 42.29 ± 3.15, K3–K4 classification). Common discomfort was reported in the amputated thigh, sound-side thigh, and ankle. Design adjustments were collaboratively proposed, including socket fit improvement, knee joint reinforcement, and coupler alignment.
**Conclusion:** This study highlights the value of structured user feedback in guiding local prosthetic refinement. It demonstrates how participatory methods can support inclusive design and technical strengthening for community-based production.

## 1. Introduction

Walking disabilities represent the most prevalent functional limitation in Indonesia, accounting for 68% of all disability cases identified in the 2020 Inter-Census Population Survey, which recorded 1.43% of Indonesians as having a disability [1]. Most of these individuals are in the productive age range of 18-60 years old. These impairments stem from various causes, such as congenital disorders, neuromuscular conditions, traumatic amputations, polio, and paralysis [2]–[5] impose severe limitations on mobility, economic participation, and quality of life. Numerous studies confirm that lower limb amputations profoundly impact physical, psychological, and social well-being, affecting daily function and emotional health [2], [6], [7].

Globally, the World Health Organization (WHO) estimates that approximately 0.5% of the population in low- and middle-income countries (LMICs) requires prosthetic or orthotic devices [8], [9]. However, limited financial accessibility remains a critical barrier, especially in countries like Indonesia, where imported prosthetic solutions are often unaffordable [10]–[12]. Additionally, secondary complications such as skin irritation, pressure sores, and long-term musculoskeletal issues further exacerbate the challenges for prosthetic users [11]–[13]. This context has fuelled local initiatives to provide affordable, accessible prosthetic devices, while global research increasingly emphasizes technological innovations to enhance socket functionality and user experience [14]–[17].

One such initiative is Independent Disabled Creativity Foundation (IDCF), a community-based small and medium enterprise (SME) led by individuals with disabilities. IDCF plays a crucial role in empowering the disabled community by producing affordable prosthetic limbs while providing economic opportunities for disabled artisans. Despite their significant contributions, recurring complaints from users regarding socket discomfort and limited prosthetic functionality highlight the need for design improvements and technical support [13]. Recent studies report that socket discomfort and poor biomechanical fit are among the leading causes of dissatisfaction and prosthesis abandonment. For example, Fatone (2021) found that socket fit significantly influences user-reported mobility and comfort, while Turner (2022) documented persistent socket interface issues in LMIC settings [15], [18].

To address design challenges within the local Indonesian context, the Biomechanics Research Team at the Faculty of Mechanical and Aerospace Engineering (FTMD), Institut Teknologi Bandung (ITB), developed an innovative 4-bar linkage D2 type knee joint featuring voluntary control characteristics and adjustable stability mechanisms [19]. This technological advancement aims to complement the socket systems produced by Independent Disabled Creativity Foundation (IDCF) [20], [21]. However, integrating this advanced biomechanical component into locally manufactured prosthetics requires careful adaptation to user needs and SME production capacities.

This study contributes by supporting the application of ITB's biomechanical joint design into IDCF's community-based prosthetic production, strengthening the local SMEs' technical capabilities to deliver transfemoral prostheses. By combining structured user feedback, through tools such as the Locomotor Capabilities Index (LCI) [22], [23], Amputee Mobility Predictor with Prosthesis (AMPPRO) [24], and Rating of Perceived Discomfort (RPD) [25]–[27] with the SCAMPER method for design refinement [28], this study offers practical, evidence-based improvements to IDCF's prosthetic products. This structured feedback approach aligns with global prosthetics research trends, which prioritize patient-centered design supported by sensor-based pressure assessments, adaptive socket modeling, and robotic limb technologies [15], [16], [26]. In this study, empowerment refers to (i) strengthening the technical decision-making capabilities of a community-based SME and (ii) promoting inclusive participation by artisans with disabilities in the prosthetic design refinement process.

This exploratory, practice-based study documents a collaborative improvement effort between ITB and IDCF, with IDCF serving as a production partner and co-designer in structured modification sessions to ensure technical feasibility and user alignment. This collaborative approach between academia and SMEs represents an initiative transfer of knowledge that empowers local communities, supports social enterprises, and promotes inclusive economic development. This study demonstrates a framework for integrating user-centered design into community-based prosthetic development, which may inform similar initiatives in other localized settings.

Given the high prevalence of walking disabilities in Indonesia and the critical barriers faced by prosthesis users, ranging from financial constraints to technical limitations, there is an urgent need to improve the quality and accessibility of locally produced transfemoral prosthetics. Despite promising grassroots initiatives like IDCF, existing solutions often suffer from suboptimal socket fit and biomechanical performance, which significantly hinder user comfort and mobility. These challenges, combined with the lack of structured, user-centered evaluations in Indonesia's prosthetic landscape, underscore the necessity of applied research that bridges technological innovation with local production capabilities. Addressing this gap is vital to ensure that affordable prosthetic devices not only meet economic constraints but also align with the functional and ergonomic needs of users. Therefore, this study is urgent in its aim to empower community-based enterprises with practical tools and evidence-based methods for refining prosthetic designs, thereby contributing to more inclusive, sustainable, and effective rehabilitation solutions.

Despite the valuable efforts of local initiatives such as the Independent Disabled Creativity Foundation (IDCF) in producing affordable transfemoral prosthetic limbs, many users continue to report discomfort related to socket fit and limitations in functional performance. These recurring issues indicate that the current prosthetic designs may not yet meet users' biomechanical and ergonomic needs, especially in the absence of structured, user-centered evaluation methods. Moreover, there is a noticeable gap in the literature regarding practical strategies to enhance locally made prosthetic devices through direct collaboration between academic institutions and community-based producers. This study, therefore, seeks to address

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three central problems: how to accurately assess the locomotor capabilities and user discomfort of IDCF prosthetic limbs, how to identify and implement design improvements based on user experience, and how collaborative design approaches can be effectively integrated into SME production processes to enhance technical capacity and user satisfaction.

The main objective of this study is to support the refinement of locally produced transfemoral prostheses through participatory design and evidence-based evaluation. Specifically, this research aims to assess the functional performance and user comfort of IDCF's prosthetic limbs using established instruments such as the Locomotor Capabilities Index (LCI), Amputee Mobility Predictor with Prosthesis (AMPPRO), and the Rating of Perceived Discomfort (RPD). Additionally, the study seeks to translate user feedback and test results into concrete design recommendations using the SCAMPER method, thereby generating feasible improvements aligned with IDCF production capacity. By facilitating structured co-design sessions between researchers and disabled artisans, this study also aims to establish a replicable framework for university SME collaboration that strengthens local innovation ecosystems and promotes inclusive economic development in low-resource settings.

## 2. Method

### 2.1. Study Design and Participants

This work was a single-group, user-centered pilot evaluation of a transfemoral prosthetic-leg prototype. The study combined quantitative functional testing in a controlled laboratory environment and qualitative, semi-structured interviews followed by a SCAMPER-based co-design workshop with amputee users and prosthetic artisans.

Seven male adult transfemoral amputees were recruited through IDCF and its local network of prosthesis users. All participants regularly wore prosthetic limbs and met general inclusion criteria adapted from Fatone, including the ability to walk independently and no major circulatory or cognitive impairments. Their mean ± SD age, body mass, and height were 33.6 ± 7.0 years, 56.9 ± 8.5 kg, and 164.7 ± 4.1 cm. This study employed purposive sampling and did not use power analysis, which is consistent with its exploratory, practice-oriented approach. Participants gave a written informed consent form before the data collection process. The experiment adheres to the ITB Human Research Ethics Committee.

### 2.2. Instruments

To assess the participants' performance and functional abilities with their prosthetic leg, the Locomotor Capabilities Index (LCI) questionnaire was used. The LCI questionnaire consists of 14 questions; each answer was required on a scale of 0-4 [20], [29]. This questionnaire has been found to be a valid and reliable tool for understanding factors that predispose, enable, and strengthen the use of prostheses. The participants' functionality was also measured using the Amputee Mobility Predictor with Prosthesis (AMPPRO), which is a well-established technique for measuring the capabilities and functional status of above-knee or below-knee amputees based on several parameters, including balance when sitting, simple mobility, balance when standing, and walking posture [22]. AMPPRO can help determine MFCL (5-level functional classification system), a tool used to predict ambulatory capabilities and as a prosthetic design guideline for patients who meet the requirements from Medicare. MFCL consists of 5 levels, ranging from k-level 0 to k-level 4. AMPPRO has been shown to have high inter- and intra-rater reliability and uses practical clinical tools. The rating of perceived discomfort (RPD) was measured using Borg's scale to measure the participants' subjective discomfort during the experiment. RPD is widely used to measure subjective discomfort and exertion and has been found to have good inter- and intra-rater reliability [25], [27].

Qualitative data were gathered through structured interviews conducted after the assessments. These interviews explored participants' personal experiences, complaints, and suggestions for improving the prosthetic design, enriching the quantitative findings with user-centered insights. In addition, this study applied the SCAMPER method, an acronym for Substitute, Combine, Adapt, Modify, Put to Other Uses, Eliminate, and Rearrange to systematically generate design improvement ideas. This method facilitated structured brainstorming sessions involving both the research team and the artisans at IDCF, ensuring that the proposed modifications aligned with the production capacities of the SME [28]. A basic thematic approach was used to summarize user feedback, organized under the SCAMPER framework. Coding was conducted independently by two team members and reconciled through discussion. While no formal inter-rater reliability was calculated, consistency was ensured through iterative review. This process was descriptive and did not involve formal qualitative and quantitative data triangulation.

### 2.3. Prototype and Procedure

In this experiment, the components of a prosthetic leg were tested, including the socket, knee joint, calf component, and SACH foot (see Figure 1). The socket was custom-made by KKD's workshop using metal sheets coated with resin and was tailored to each participant's stump. The knee joint, designed by the FTMD ITB biomechanics research team, was a 4-bar linkage D2 type with voluntary control characteristics and a constantly changing instant center during the gait cycle. The suspension system in the knee joint helps to maintain the user's stability, and the joint is equipped with a rotator to enable twisting in the transverse plane [20]. The adjustable calf component allows the length of the prosthetic leg to be adjusted, and the SACH foot provides a stable and cushioned surface for the user to walk on. Overall, these components work together to create a functional and customizable prosthetic leg for individuals with leg disabilities.

Participants filled out the LCI questionnaire and calibrated the RPD scale by lifting a 4 kg load with both arms extended forward at a 90-degree angle to their body. This calibration was designed to provide the participants with a feeling of discomfort, and it was rated nine on the RPD scale. After the calibration, the participants filled out the AMPPRO questionnaire before

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performing predetermined simple activities (Figure 2). After completing each activity, the participants filled out the RPD questionnaire again. All data collection processes were recorded using a GoPro camera.

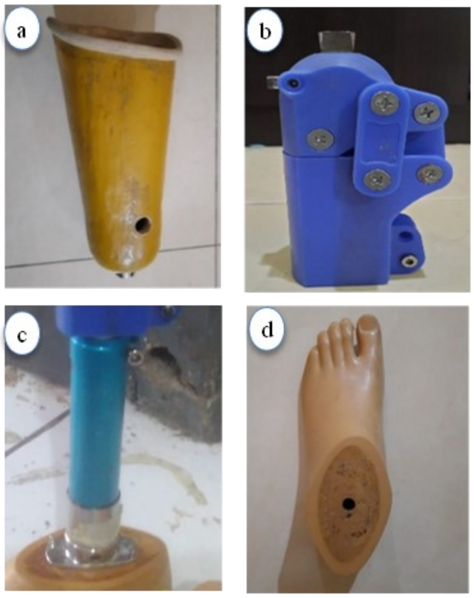


**Figure 1.** (a) Socket, (b) Knee joint, (c) Calf component, (d) SACH foot

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The following steps were performed to analyze data. The LCI scores for each participant were calculated and aggregated to obtain a group score. The data obtained from the AMPPRO questionnaire was summarized, and the participants were categorized based on their scores. Scores of 15-26, 27-36, 37-42, and 43-47 were classified as K1, K2, K3, and K4, respectively. The RPD scores for each participant were calculated, and their statistical significance was tested. The normality and homogeneity of the data were tested using the Shapiro-Wilk and Levene tests, respectively. If the data was homogeneous and normally distributed, one-way ANOVA was used to test the significance. The Friedman test was used instead if the data was not normally distributed. The interview data was summarized, and conclusions were made based on the participants' opinions, inputs, and complaints about the prosthetic leg. The significance level was set at $\alpha$ <0.05. Due to the limited sample size, effect sizes, and confidence intervals were not reported. The small sample size also limited the statistical power of this study. As such, no correlational or regression analyses were conducted between LCI, AMPPRO, and RPD scores. Future research should explore these relationships with larger and more diverse cohorts.

**Figure 2.** A participant performs AMPPRO activities under the supervision of the experimenter the heading should run into more than one line, the run-over should be flushed left.

## 3. Results and Discussion

This study was conducted as a participatory community-based effort to evaluate and improve a locally produced transfemoral prosthesis. The main objective was to gather structured user input, through mobility tests, discomfort ratings, and co-design discussions, to support technical refinements suited to the local production context at IDCF. The results presented here reflect practical insights from a small group of users selected purposively based on their experience with prosthetic use. As this was not an experimental or clinical study, the outcomes are not intended to be generalizable but instead to serve as actionable input for product improvement and ongoing SME capacity building.

The Limb Capacity Index (LCI) ratings of each participant in the study ranged from 42 to 56, suggesting that they were all independent when using their prosthetic leg for daily tasks (see Table 1). Three individuals, however, scored in the level K3 category on the AMPPRO test, while four others scored in the level K4 category. Participants who have reached level K3 can ambulate with varying cadence and navigate obstacles in their environment. In contrast, participants in level K4 had the capability or potential to engage in high-pressure, high-energy, and high-impact activities such as sports or recreation. Another difference between the two levels is that individuals at level K4 can use any type of ankle system, while those at level K3 are limited to using a flexible leg system, an energy storage system, a multiaxial ankle, or their equivalents. This shows that even though some participants may have the same locomotor ability, they can have different levels of functionality. This phenomenon may be caused by the inability of LCI to detect the difference in perceiving mobility during the use of leg prosthetics [24].

Several notable observations regarding participants in the level K3 category when using the


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prosthetic affect their comfort and performance. For example, participant number 1 wore a smaller socket compared to their stump, reducing comfort. This occurred because there was a significant time gap between the socket production and the experiment, and the participant's stump increased. Participant number 4 felt uncomfortable with their socket and suffered scratches on their stump after data collection. Finally, Participant Number 7 had only started using a prosthetic the previous year and was not used to wearing an unfamiliar prosthetic. These participants also scored low on the AMPPRO test. Incompatible sockets can disturb gait patterns, increase the risk of falling, and cause severe injuries. People with leg disabilities may also feel dissatisfied, uncomfortable, and unable to use a prosthetic without a fitting socket [18], [30].

**Table 1.** LCI and AMPPRO results

| Participant | LCI score | AMPPRO score | K-Level |
|---|---|---|---|
| P1 | 44 | 40 | K3 |
| P2 | 56 | 44 | K4 |
| P3 | 55 | 45 | K4 |
| P4 | 49 | 38 | K3 |
| P5 | 56 | 45 | K4 |
| P6 | 49 | 45 | K4 |
| P7 | 50 | 39 | K3 |
| Mean | 51,00 | 42,29 | |
| Std. Dev | 5,10 | 3,15 | |

According to Schmalz et al. [31], people with leg disabilities who use a prosthetic can typically only intuitively utilize newly installed components after adapting to them for several hours if the gait pattern is similar to their previous prosthetic. If the new prosthetic has distinct new functions, the user may need more time to study the new gait pattern. In this experiment, the participants' previous prosthetic type was not considered, so it is unclear whether the difference in their functionality was affected by their difficulty adapting to the new prosthetic. People with leg disabilities may need up to three months to adapt to a new prosthetic fully.

All seven participants completed all activities required in the AMPPRO test, including sitting, standing, walking, and several other simple tasks. This indicates that even individuals with leg disabilities in the K3 category can use the tested above-knee leg prosthetic prototype. This promising result suggests that the prototype is usable for people with these types of disabilities.

Differences in mean values of RPD were tested between each AMPRO activity for eight different body parts: waist (amputated side (AS) and not amputated side (NAS)), hip (AS and NAS), thigh (AS and NAS), knee, and ankle. A one-way ANOVA test was used, which requires the data to be normally distributed and homogeneous (Table 2). The Friedman test was used if the data was not normally distributed (Table 3). The results showed that using the prosthetic leg prototype significantly impacted perceived discomfort in the thigh (amputated side and not amputated side) and ankle during the performance of AMPPRO activities.

The highest mean value for the rate of perceived discomfort (RPD) in the stump was recorded while walking at various speeds and overcoming obstacles [32]–[34]. Several factors can cause discomfort in the stump, including incorrect prosthetic usage, atherogenic, neurogenic, and changes in stump geometry. Stump geometry may change over time, affected by prosthetic usage, climate change, gait pattern, and changes in blood circulation in the lower body. The compatibility and comfort of wearing a prosthetic socket is an important factor contributing to the successful use of an above-knee prosthetic [35]. Significant pain in the stump may be caused by the underlying reason for amputation, as 70% of participants are amputated due to accidents or trauma [32]. Meanwhile, pain in other parts of the leg is commonly experienced by people who have been amputated due to trauma, which can affect the blood vessels in the remaining limb.

**Table 2.** Results of one-way ANOVA for RPD data

| RPD Parameter | F | Sig. |
|---|---|---|
| Waist NAS | 0,879 | 0,590 |
| Hip AS | 1,240 | 0,257 |
| Knee | 0,589 | 0,877 |

**Table 3.** Results of Friedman test for RPD data

| RPD Parameter | Chi-square | Sig. |
|---|---|---|
| Waist AS | 15,524 | 0,414 |
| Hip NAS | 22,636 | 0,092 |
| Thigh AS | 34,610 | 0,003 |
| Thigh NAS | 33,491 | 0,004 |
| Ankle | 32,261 | 0,006 |

An incorrect length of the prosthetic leg may cause a significant RPD score for the non-amputated thigh. Pain in the upper leg is a common complaint among amputees, often caused by an incorrect prosthetic length and asymmetry between the right and left legs. Poor gait patterns and posture can also cause pain in the knee and hip over time. Previous research [11], [12] has shown that after amputation, the body will often try to reduce the use of the remaining limb due to pain or fear, but this can lead to further damage to the healthy portion of the body. Additionally, the participants in the study may not have worn the prosthetic leg for long enough to adapt to it.

Significantly higher perceived discomfort ratings in the ankle can be explained by previous research [36]. The research shows that individuals with leg disabilities lose control over their ankle, causing the normal-side ankle to actively maintain the person's stability in the anterior/posterior (AP) direction. When a person with an above-knee disability stands and experiences perturbations in their lower extremities, their body will try to maintain balance by increasing their use of the ankle [37].

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There are many differences between the activities involved in sitting and simple activities such as walking or standing. The ankle supports compressive forces up to 5 times the body weight, and the ankle joint reaction force reaches 5.2 times the body weight during normal walking [37]. Meanwhile, the remaining ankle is more heavily relied upon as compensation for the limited movement of the prosthetic side, which leads to an increase in the range of motion [38]–[40].

It was noted that significant discomfort was experienced in the thigh-amputated side, thigh-not amputated side, and ankle. One potential cause for this is the upper part of the socket being too hard. To address this, it is suggested that the socket be made with two different materials, with a readily available soft material such as latex or silicone used for the upper part of the socket that directly contacts the user's stump. Soft materials such as gel, silicone, or elastomers in the socket can absorb shocks, easily fit the stump, and transfer pressure well. This proposed design can be implemented according to the KKD head of production. Additionally, it is recommended that the socket be made by molding to the user's stump to ensure shape similarity. A better-fitted socket means better durability and can prevent traumatic limb and dermal problems after extended use [13].

The idea generation process was carried out by brainstorming using the SCAMPER method, as presented in Table 4. Results from LCI, AMPRO, and RPD were discussed in the SCAMPER discussion with IDCF. For example, discomfort in the anterior distal thigh and lateral knee, identified through RPD scores, corresponded to user complaints of socket instability and pressure buildup. This issue directly informed design changes to the thigh band and socket contour. Similarly, variations in AMPPRO scores were discussed during the SCAMPER workshop to evaluate which modifications had the potential to improve gait balance and perceived safety. Several proposed modifications were rooted in user interview insights. For example, one participant noted, " The bottom of the socket feels sharp when I use it.," which prompted a redesign of the socket contour through a better molding technique. These user-derived insights were categorized alongside technical considerations raised by the IDCF team during co-design discussions.

To improve the design of the knee, it is suggested that the gap between the connector bar and the main body of the knee be narrowed to increase stability in the medial-lateral direction and provide better control to the user. Arifin [9] found that individuals with above-knee leg disabilities often have insufficient control in shifting weight to maintain posture, which can lead to instability in the medial-lateral direction. The prosthetic knee prototype is wobbly and unstable in this direction due to the oversized gap between the connector bar and the main body of the knee. Narrowing this gap can improve user stability and control. A lock feature is also proposed to address a problem identified during the data collection. When the knee is locked, the prosthetic leg is safer when walking on inclined, uneven, or challenging surfaces. However, locking the joint may reduce walking speed and increase energy consumption [41], [42]. The proposed lock feature allows the user to choose whether to lock or release the joint.

**Table 4.** SCAMPER Results

| SCAMPER | Remarks | Source |
|---|---|---|
| Substitute | Replace the material and production method for the socket, add a locking feature, and replace the material of the knee joint. | ITB team and IDCF |
| Combine & Adapt | Adapt socket molding technique and combine it with a locked and swinging joint system | User, IDCF, and ITB team |
| Modify | Modify the socket-joint adaptor based on collected data to improve comfort and fit | User and ITB team |
| Put to Other Uses & Rearrange | No component functions can be rearranged, but we can improve the connection between the calf and joint by adding thread or sandpaper to the gap. | IDCF |
| Eliminate | Eliminate the use of low-strength materials and design a stronger socket-knee adaptor to improve durability and performance. | IDCF |

While the co-designed adjustments appeared to address some user-identified issues in socket fit and joint stability, these findings should be interpreted as context-specific and preliminary. The results suggest potential directions for local refinement but do not establish causality or clinical effectiveness. Nevertheless, this study significantly contributes to community empowerment through capacity building within SMEs. Specifically, the collaboration with IDCF demonstrates how academic research and technological innovations can be transferred directly to local enterprises, enhancing their technical expertise and product quality.

By systematically integrating user-centered evaluations such as the LCI, AMPPRO, and RPD, along with applying the SCAMPER method for design improvement, this study equips IDCF with practical tools and methodologies that can be embedded into their regular production processes. These tools enable IDCF to continually refine their prosthetic products based on direct user feedback, ensuring that their solutions remain both affordable and responsive to the specific needs of the disabled community.

This study has several limitations that should be acknowledged. First, the number of participants was limited to seven transfemoral amputees recruited through a single community partner, which restricts the generalizability of the findings. Second, the short adaptation period may have influenced participants' ability to assess comfort and functionality fully. Third, while user feedback was collected through structured interviews, it was not analyzed using a formal qualitative coding framework, and inter-rater reliability was not assessed. The SCAMPER method was also used as a heuristic tool for idea generation rather than a validated evaluation framework. Finally, the absence of long-term follow-up limits insights into the durability and sustained impact of the prosthetic refinements.

Despite these limitations, this study provides practical insights into how structured user feedback and participatory design methods can support affordable prosthetic development. It also highlights a collaborative model between ITB, which developed the prosthetic knee joint,

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and IDCF, which produced the socket and other prosthetic components, demonstrating the potential of university–SME partnerships to address community health needs.

While this study focused on a single iteration of design and evaluation, an informal training session was conducted with IDCF staff to transfer knowledge about the rationale and technical aspects of the modifications. The design changes were also documented to support repeatability within the SME's workflow, and ongoing discussions are being held to facilitate user follow-up and identify further design needs. Future studies should investigate the durability of such interventions over time and explore models for replicating these methods in other low-resource communities.

## 4. Conclusion

The functional analysis of the above-knee prosthetic leg reveals that all participants' locomotor abilities can be classified as independent. However, according to the AMPPRO test, three participants belong to the level K3 category, and four others belong to the level K4 category. This shows that even though some participants may have the same locomotor ability, they can have different levels of functionality. This phenomenon can be explained by the inability of LCI to detect the difference in perceiving mobility while using leg prosthetics. Incompatible sockets can disturb gait patterns, increase the risk of falling, and cause severe injuries. People with leg disabilities may also feel dissatisfied, uncomfortable, and unable to use a prosthetic without a fitting socket. The participants' previous prosthetic type was not considered, so it is unclear whether the difference in their functionality was affected by their difficulty in adapting to the new prosthetic. All seven participants were able to finish every activity required in the AMPPRO test, so we can conclude that people with leg disabilities in the level K3 category are able to use the tested above-knee leg prosthetic prototype.

This study demonstrates the potential of structured user feedback to guide affordable prosthetic refinement within a community-based setting. While the findings are specific to IDCF and the user group involved, the participatory process and practical assessment tools may inform similar initiatives in comparable contexts. Follow-up efforts, including technician training and long-term user feedback, are planned to support the sustainability and iterative evolution of the modified designs. Future studies should focus on long-term adaptation processes of amputees using the improved prosthetics, as well as the scalability of this collaborative model to other SMEs in Indonesia and similar low- and middle-income countries.

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