Local Bamboo as a Cost-Effective Construction Material for Daily Use Wheelchairs and Sports Chairs: Increasing Mobility Accessibility for Persons with Disabilities in Socioeconomically Disadvantaged Settings

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KEGGI-KIMBALL FUND FOR INTERNATIONAL ORTHOPEDIC EDUCATION
International Paralympic Committee (IPC)

**Vision**
Make for an inclusive world through Para sport.

**Mission**
To lead the Paralympic Movement, oversee the delivery of the Paralympic Games and support members to enable Para athletes to achieve sporting excellence.
My inspiration

Maclean Atsu Dzidziienyo
Ghanaian Paralympic Athlete

Raphael Botsyo
3-time Paralympian for Ghana
Interlinked elements\textsuperscript{1,2}
Paralympic values

- Courage
- Determination
- Equality
- Inspiration
How can we increase the accessibility of mobility for persons with disabilities in socioeconomically disadvantaged settings?
Importance of mobility

Globally, immobility is associated with:

- Increased poverty rates\(^3\)
- Social stigmatization\(^3\)
- Higher rates of chronic disease\(^4\)
- Higher rates of mental illness\(^5\)

Ayishetu Seidu – Ghanaian wheelchair racer
How can we increase the accessibility of mobility for persons with disabilities in socioeconomically disadvantaged settings?
Bamboo wheelchair

5-15% of 65 million people have access\textsuperscript{2,3},

Excess of bamboo used for many applications.
Urban design

Rural design
# Specifications

<table>
<thead>
<tr>
<th></th>
<th>Urban Design</th>
<th>Rural Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (kg)</td>
<td>~10 kg</td>
<td>~11 kg</td>
</tr>
<tr>
<td>Seat height* x width x depth (cm)</td>
<td>46.5 x 32 x 38.5</td>
<td>46.5 x 43 x 38</td>
</tr>
<tr>
<td>Total height (cm)</td>
<td>72.5</td>
<td>71</td>
</tr>
<tr>
<td>Total width (at rear wheels)</td>
<td>32</td>
<td>42</td>
</tr>
<tr>
<td>Total length (cm)</td>
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<td>93</td>
</tr>
<tr>
<td>Estimated production time (hr.)</td>
<td>16</td>
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</tr>
<tr>
<td>Estimated cost of goods (USD)**</td>
<td>110</td>
<td>120</td>
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*measured at the back of the seat  
** based on prices in Ghana
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Design process

Sketches of the rural bamboo wheelchair design

Bamboo used for construction

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<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
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<tbody>
<tr>
<td>Inner Ø [mm]</td>
<td>30</td>
<td>35</td>
<td>37</td>
<td>40</td>
<td>23</td>
<td>25</td>
<td>32</td>
<td>23</td>
</tr>
<tr>
<td>Outer Ø [mm]</td>
<td>17</td>
<td>20</td>
<td>20</td>
<td>12</td>
<td>15</td>
<td>18</td>
<td>17</td>
<td>15</td>
</tr>
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Most important design considerations

Material properties bamboo

• Variation amongst bamboo
  ▪ Age
  ▪ Moisture content
  ▪ Origin
  ▪ Part of stem

• High compressive strength

Ease of design/construction

Close-up view of the joints of the bamboo wheelchair
## Cost analysis

<table>
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<tr>
<th>Regular Wheelchair</th>
<th>Bamboo Wheelchair</th>
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<td>90 USD</td>
<td>120-130 USD</td>
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*Regular foldable wheelchair from Tonaton, Accra, Ghana*

*Bamboo wheelchair, Paris, France*
What distinguishes the bamboo wheelchair over others?

❖ Cultural pride
  ▪ Empowerment of individuals

❖ Accessibility
  ▪ Easily custom-made
  ▪ Functional

❖ Sustainability
  ▪ Local and natural resources
Future of the bamboo wheelchair...
Conclusion

Increase the *accessibility* of *mobility* for persons with disabilities in socioeconomically disadvantaged settings:

- With abundant natural local materials
- In collaboration with local people

- Expand global participation in the Paralympic Movement
- Make for an inclusive world through Paralympic sport
Conflict of interest disclosure

- ✔️ No, nothing to disclose
- Yes, please specify:
References


Acknowledgments

Yetsa A. Tuakli-Wosornu, MD, MPH
Sports Equity Lab at Yale
Keggi-Kimball Fund for International Orthopedic Education
Stichting Inzet der Lage Landen - Ad van Klaveren
Eric Asante
Go Get Dem Wheelchair Racing Club, GGDWRC
Meet Africa, volunteering NGO
University of Delaware, ME & BME department
Ghana Bamboo Bikes Initiative, GBBI
Bright Generation Community Foundation, BGCF