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INCLUSIVE BUSINESS INNOVATION: IMPROVING PRODUCTIVITY OF BRASS HANDICRAFT INDUSTRY

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Abstract— This paper presents analysis of a problem that concerns primarily the brass artisans of Moradabadand its plausible solution. The brass work of Moradabada town in the state of Uttar Pradesh, India is a dying art and is faced with a multitude of problems whose scope ranges from infrastructural, business and productivity to many others. The most glaring of those problems was regular work generation and low productivity. Thisresearch aims to tackle the obstacles for brass handicraft workers through an original product prototype; especially brass engravers while describing and explaining the processesinvolved in this industry. Also, a solution of this nature can be easily pivoted to other handicraft industries as well, like copper handicrafts in Kashmir, horn and bone carvings, shell craft in coastal areas etc., which face problems of similar nature and do highly skilled hand work. Modifying to these industries will require some changes but the main theory in effect will be primarily the same.

Keywords— Handicraft; Brass; Inclusive Innovation; Bottom of Pyramid; Social Innovation

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I. INTRODUCTION

In 2006-07, the total export turnover from Moradabad where 400,000 brass workers are employed was Rs 3200 crore, which drastically came down to Rs 1800 crore in 2011-12, mainly due to business reasons. Brass handicraft requires 11 different manufacturing processes and labourers are employed in different stages of manufacturing of these articles.Each process require very specific skills.

The most skilled of the lot, engravers are the people around which this industry revolves. These people have no access to financing solutions, and often rely on the payment of the previous goods sold, which is highly uncertain. They receive money only when the product is finally sold off in the relevant shop. Hence, there is no scope of buying the raw materials beforehand and start working on the next cycle of goods. This paper targets these skilled engravers through a solution because various aspects. The artisans because of whom the Indian handicraft industry is so massive, are very under-served and do not receive a fair value for their work.The problem for these people who belong to the segment of society termed as 'Bottom of the Pyramid' was of an economic dimension; whilst the middlemen made a lot of money, they were provided with a small share of their own efforts. These artisans are rigid in terms of changing ways and means and therefore are okay with middlemen because of whatever little business they provide them. They believe that no technological solution would be able to help them as the intricacy level of their hand work cannot be matched my by an unskilled person or the best of machines. Hence, major efforts need to be put in to safeguarding intangible cultural heritage or they would simply become history.

II. PRIMARY RESEARCH &LITERATURE REVIEW

Processes involved in making a brass handicraft product from scratch are:

- Pattern Making
- Ingots making
- Moulding & casting
- Welding/Brazing
- Soldering &Riveting
- Filing
- Scraping

- Tinning & Electroplating
- Finishing & Polishing
- **Engraving**
- Coloring

Figure 1: Engraving

The work being of wide variety, there was a large spectrum of problems that needed to be tackled. Moradabad, the brass hub of India has a very poor electricity supply.

The communities being poor, they don't have proper workspaces. Since metal handicrafts generate a lot of metal shards and dust, their families are almost constantly plagued with eye infections and tuberculosis. But the biggest of all is the financial problem. The nature of this industry is very seasonal. These people lack upfront capital and are unable to carry on with their artworks due to lack of money to buy raw materials during off season. Whereas, ironically they are never able to fulfill the demands during peak seasons when they receive bulk orders and miss out on potential earnings. Low income is also indirect result of poor productivity. Most of the articles are very delicate which are sold at high prices in the market and can only be worked upon in sunlight because of very fine engraving works involved and lack of proper lighting inside their house. As a result, working hours on such high value products get restricted. Long time period of work per product means some of the very valuable take a lot of time to complete due to lighting constraints.

Figure 2: This fine brass work takes 4 months to complete the detailing; can be worked under sunlight only

A report on Indian artifacts sector [2]highlights problems in a fragmented crafts value chain, namely poor organizational structure, procuring raw materials, production, markets and demand. The discussion briefs about the information asymmetry, inadequate inputs and an unfair value chain. Working Group report on handicrafts for 12th Five Year Plan[3], a chapter on handicrafts in the Uttar Pradesh Development Report[4], an article on inclusivity of business models[5]all lay the groundwork for having overview of situations of Moradabad brass engravers. The working group report talks about the targets that were laid down at the beginning of the FYP and how the growth of this industry has turned out. The discussion commences with the recovery of exports after global recession, citing a registered growth of approximately 20%. A remarkable figure of INR 28368 crore for handicrafts export was projected for the coming five years. It gives the guidelines for policies and programs targeted towards this sector namely, Baba Saheb Ambedkar Hastshilp Vikas Yojana among others. The lack of technological infrastructure and ineffective efforts to improve a fragmented supply chain are also talked about.

A study [6] in this city related to the condition of workers and the child labour in Moradabad revealed that this city has 600 export units and 5000 industries in the district, with their exports to countries such as USA, Britain, Canada, Germany and Middle East amounting to over Rs. 2200 crore. While these numbers sound very interesting the state of the real heroes behind these astonishing arts still live under woeful state and sometimes in extreme poverty. Another report[7] by Ganesh Kumar and S Venkataramaiah mentioned that there are about 14,500 household units dedicated for brass handicrafts. There lied potential of technological breakthroughs and social innovation to increase the productivity.

III. METHOD

The problems that were targeted for an inclusive innovation were the restricted working hours, protection from metal shards and indirectly, lack of upfront capital. This paper proposes a solution which would allow them to work even without sunlight and could protect them from metal shards and dust particles, hence reducing health hazards and increasing productivity.If their productivity of engraving is increased, they can work for longer hours during the peak

demand time, will earn more money, and keep upfront capital, which improves the entire product cycle.

There have been for profit initiatives like Fab India and Mother Earth which aims at making handicraft business robust and more profitable through an efficient supply chain. However good these might look, they have failed to benefit the very grass root labourers. Therefore the following solutions were proposed:

1. Lens based focusing apparatus

A convex lens to actually focus light from a light source to the brass article.

2. Reflection of light from a paraboloid mirror (E)

If light is sent to a parabolic surface from the focus of the parabola, the light that gets reflected becomes parallel. This can be used to send the light in the right direction increasing the intensity at the object.

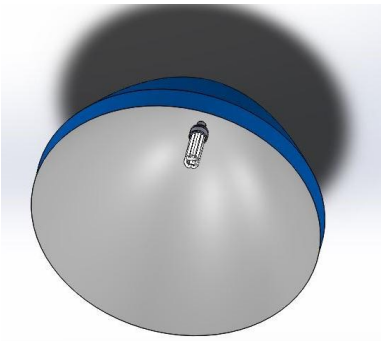

Figure 3: Paraboloid reflector

3. Adding a Magnifier

Since this is very fine work, incorporating a magnification structure could increase their work speed significantly. However, this solution was subject to how much it changes the style of the artisan as a significant change in style will not be taken up by the artisan. It in fact was rejected by most of the workers since it won't fit their style of working

4. Umbrella protection (A)

A small umbrella structure around a glass surface to protect from shards. As only the eye region needs to be covered.

5. A multi light paraboloid (B)

Structure with light sources attached to the sides instead of the center.

6. A reflector mount (C)

That can be mounted on the hanging lights that were typically observed in Moradabad.

Figure 4: Combination of the reflector and protection units

The structure shown in Figure 4 has a magnifying glass structure at the center, with a planar sheet around it to protect from metal shards. This inspiration was derived from the face cover that is used in welding.

The solutions were evaluated on the parameters of affordability, energy efficiency, high luminosity, adaptability, maintenance & repair and feasibility.

IV. DISCUSSION

A decision matrix was used to choose one final solution. T

Criterion (Multiplier)	A Multi-light Umbrella	B Bin	C Perfect paraboloid	D	E
Affordability(0.2)	2	5	3	4	4
Energy efficiency(0.15)	3	2	5	3	3
Intensity(0.3)	5	3	5	3	3
Adaptability(0.2)	2	4	4	4	3
Maintenance and repairability(0.08)	1	4	3	4	3
Additional Increase in work speed (0.07)	4	4	4	4	4
WEIGHTED TOTAL (of 5)	3.11	3.3	4.17	3.55	3.27

This matrix was used to make a final decision on the shape of reflecting surface to be used for a final prototype whose CAD model has been shown in Figure 4. The intuition behind the paraboloid shape of the reflector is, whenever a ray from the focus of a parabola goes to the

internal surface, the reflected beam is parallel to the axis of the parabola. This idea is something that was primarily observed in car headlights and solar cookers. The structure had to be something that could act as an add-on to the existing means of lighting the users had. Then the product's adaptability should be smooth enough to not hinder their existing working styles and techniques.The increment in intensity of light must be significant enough to justify whatever the brass workers would pay for the product; although the product should be optimized in terms of cost.

Solar powered lighting was also a parallel solution to provide a more eco-friendly solution for the problem also catering to the low number of hours of power supply in UP. There are in fact products like Gram Lite and ECCO Diva for the same. But these are not specifically catering to a particular problem of the brass engravers.

V. CONCLUSION

For validation of solution, evaluation was done on the intensity increased due to the proposed reflector on the brass work piece. The ratio of intensity of light on the product w.r.t.:

1. Open room light: 6.4
2. General purpose table lamp: 4.7

So this solution would be able to solve the lighting problem. The product had to provide sufficient enough intensity as to compensate sunlight and nicely substitute their existing lighting which is highly insufficient for the task. Although the testing of prototype worked out to be fine, some were skeptical if this product would be able to let them work in their existing working style and with ease. They were very strict about incorporating any new thing or pattern in their work. The total cost of the setup (calculated only for the purpose of estimation) turned out to be between 90 to 120 INR.

There were still some associated risks and challenges that still need to be addressed. There is no analysis of the dirt that is present in the area as the entire area is full of various kinds of suspended particles in the air. That can cause fast corrosion of the mirror surface making the product unsustainable. The engravers are also psychologically used to working under ambient yellow sunlight that they may not like working under this kind of light at all.Since the product is

directly altering the main source of bread for the people, the early adoption will be slow. However, the word of mouth would spread really fast as the engravers will be seen working for a longer time and the subsequent adoption would be very fast. Still there is need a suitable dissemination strategy to actually make people aware incase this prototype goes till product stage.

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