

# Design and Research of Rice Husk Building Block Toy Based on Mortise and Tenon Structure

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**Abstract:** *Background:* At present, many kinds of building block toys are available on the market and most of them are made of small wooden blocks played by children alone. Parents can not always accompany their children while playing, which exposes them to the danger of swallowing the toy. Nowadays, with the country's increasing prosperity, traditional culture is vigorously promoted to improve cultural confidence. A part of this culture includes "Mortise and Tenon" structure. Currently, there are few cases of applying mortise and tenon structures to building block toys. Rice husk material is used in the product composition that has the characteristics of high resistance to natural degradation, and it is not a threat if children accidentally swallow the toy. *Objective:* From the perspective of children's safety, this paper examine and analyzes the current building block toys, and innovates from the two aspects of structure and materials to better protect the children, and at the same time, to inherit and preserve the traditional Chinese culture. *Methods:* The current literature on building block toys was analyzed to understand the importance of building blocks for children's education, and then the materials was compared and analyzed to determine how different types of building blocks affect children's safety. Finally, the case study was carried out on children's building blocks to analyze how to include mortise and tenon structure with toys and use safer building blocks materials. *Results:* Through the innovation of building block material and structure, such as edible rice husk material, mortise and tenon structure, as well as parent-child interaction, the design was completed with an eye toward children's safety and enhancing both the parent-child relationship while using building block toys. *Conclusions:* 1) Children's safety as the main focus; 2) Using mortise and tenon structure to increase parent-child interaction; 3) The use of rice husk material to make building block toys more eco-friendly and safe. Using the aforementioned three aspects will serve as as the innovation points in the designs of building block toys that are more ideal for children.

**Keywords:** Building block toys; Mortise and tenon structure; Rice hull; Child safety

## 1. Introduction

### 1.1 Research Background

With the continuous development of the economy and the gradual improvement of people's living standards, parents are placing more importance on children's safety and the parent-child relationship. These give rise to the parent-child industry to create various forms of child safety education activities. Among these are children's toys that also serve as a bridge that allows preschool children to feel the world in their formative years. Playing is a vital role in children's physical and mental development. The most popular toys for children are building block toys, which have a huge market size and a wide variety of options. Children who have developed a curiosity about the world and are between the age of roughly 3-6 years old are the primary consumers of children's building blocks. These kids explore the world through toys and utilize educational toys to develop their independent thinking abilities. Chen Heqin, a researcher on children's

toys, said that "playing is the whole life of children," and toys occupy more than 60% of preschool children's leisure time (Xu, 2018). This indicates that toys are a constant companion for kids and an essential part of their lives, thus, the safety of toys is worthy of attention. Because building blocks are small in size, there is a risk that children may swallow them. Additionally, the blocks are usually made of wood, which can not be digested and may lead to digestive tract damage, asphyxia, and other risks when accidentally ingested. Nowadays, most parents have to work and can not accompany their children all the time, so having safe children's toys is a big help so they can work and still feel secure knowing their children are safe. In addition, parents are also eager to engage in activities with their children that can better promote the parent-child relationship. Since toys have become a link between parent-child emotions, there is a growing demand for children's toys that will function more interactively. Therefore, we can start with the innovation of building block toys from these two aspects, and produce building block toys that better meet the market demand.

### **1.2 Research Purpose**

By studying the material and structure of building block toys, this paper analyzes the current situation of modern children's toys and the need for innovation. Nowadays, there are endless new fashion design ideas and intense competition in the children's toy market. Furthermore, one of the main concerns of parents is that traditional building blocks toys are easy to be eaten by children. Therefore, to better meet the demands of the modern market, building block toys should adhere to the safety and interaction standards of traditional educational toys. Aside from ensuring children's safety and promoting parent-child relationships, it can also carry forward the traditional culture - mortise and tenon structure to a certain extent, so preschool children can experience the excellent traditional culture of China through building block toys. This paper further innovates the building block toy from the perspective of child safety and parent-child interaction. The target users of the study are preschool children aged 3-6 years. The safety of rice husk material is being considered versus wood material to ensure children's safety while increasing parent-child interaction.

### **1.3 Research Objective**

This paper focuses on children's building block toys in the current market, analyzes its present situation and development trend, and summarizes the limitations of the toy from user feedback as a springboard for innovative design. As a starting point for material innovations, the traditional building block made of wood has been replaced with rice husk, a material that is both safe and environmentally friendly. Since rice husk has a rough surface and a high resistance to natural degradation it has always been a difficult agricultural waste to dispose of. Creating toys out of it is one way to convert agricultural waste into useful products. Then the common splicing structure is changed into the historic mortise and tenon structure as an innovation in structure. The mortise and tenon structure is summarized as "structural science and tenon dense." It does not use a nail or glue, which shows the durability and practical characteristics of the mortise and tenon structure (Xie, 2023). Additionally, because of the diversified connection mode of mortise and tenon structure, the splicing mode of building blocks toys is more flexible and diverse, which stimulates children's thinking and also requires the participation of parents, thus promoting the development of the parent-child relationship. From another point of view, playing with parents guarantees the safety of children. In addition, the mortise and tenon structure has a long cultural history. By integrating the culture into building block toys, children can learn and experience the fine traditional Chinese culture. This research aims to combine the material and structural innovation of building block toys that are safer, interactive, culturally relevant, and in line with the current market demand.

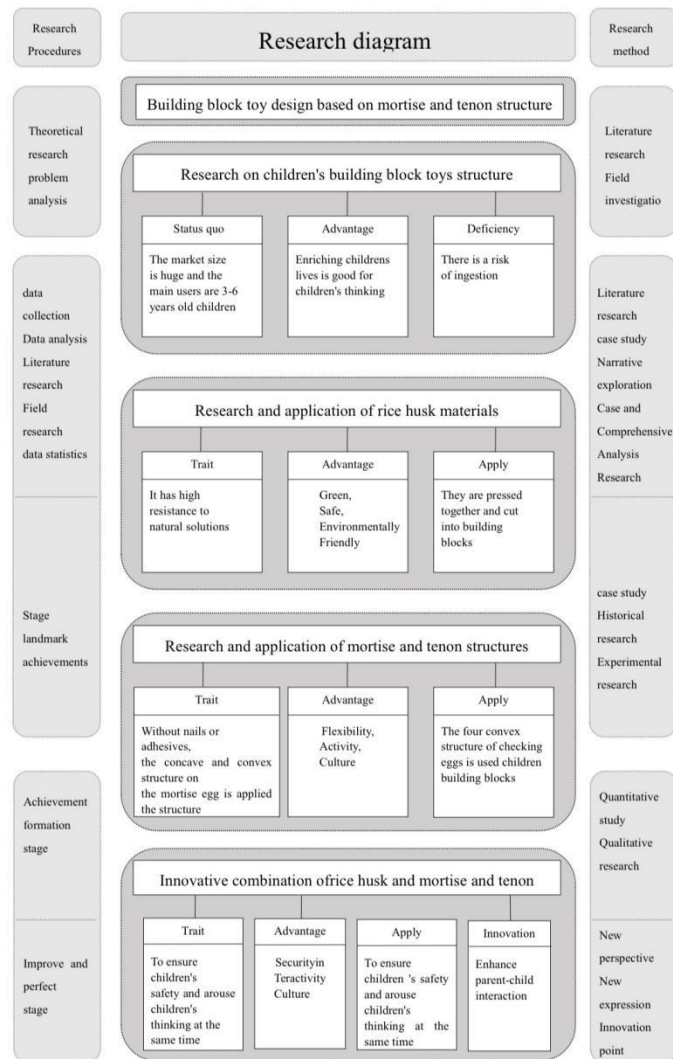


Figure 1: Frame diagram

### 1.4 Research Methods

Based on the literature analysis in the current market, we understand the demand for building block toys. By comparing the material analyses of wood and rice husk, we find the safe materials that are more suitable for children. To further understand the characteristics and advantages of rice husk material we conduct a related literature analysis on the cost and sustainable development of rice husk. It also examines the application cases of mortise and tenon structure in building block toys to understand their characteristics, such as diversity, flexibility, culture, etc. Finally, the combination of the material and structure is applied to children's building block toys as the innovation point of this study.

### 2. Literature Review

Based on the published journals and other publications, child safety has been a topic of great concern. People began to inquire about the safety of children's toys as early as the 1990s when information technology was at its early stage and the Internet became popular. In the era of advocating fewer births and better births, most families have only one child, so parents pay special attention to their children. Everyone also shifted their focus from the quantity of children to the quality of births, so child safety at that time

was already a crucial topic to discuss. Numerous toys can cause a serious threat to children's health and safety because of the disorganized, growing number of township enterprises, and the lack of unified and effective management involved in the toy production industry, hence, product quality can not be guaranteed (Wang, 1999). Thus, we consider the issue of children's toy safety standards. With the rise in popularity of the Internet and the globalization of people's information, we began to compare the domestic toy safety standards, especially for children's toys and supplies safety standards compared with international advanced standards, the result shows a significant discrepancy. For instance, in children's toys exported to the United States, 73% of the toys are unqualified and rejected, and 75% that make noise are unqualified according to Ms. Nelson and Mr. Preston of the United States Consumer Safety Commission. Only a few of the toys exported from China to the United States passed the United States customs inspection (An, 1994). This causes domestic parents to give great importance to the safety of children's toys, leading parents to accompany their children at all times. Since then, the safety of children's toys has become a big demand in the children's toy market. One of the main issues is the material used. Many children's toys contain harmful chemicals, such as lead, and excessive nitrate, which is dangerous to children's health. Additionally, using too hard and sharp materials can also hurt children when they are playing. Therefore, safe and healthy materials are vital in making children's toys. The best safe material is rice husk because it does not contain chemical residue and is made of agricultural products, so it has no adverse effects on children's health.

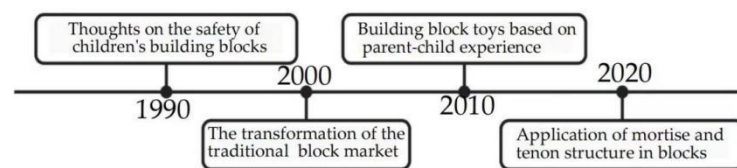


Figure 2: Building block toy development history

Building block toys occupied a large proportion of the children's toy market. When the building block toys were first developed, they were the first set of educational toys that promoted learning. As a result, building block toys are more often combined with mathematical intelligence, stimulate children's independent thinking, and help children better understand nature through games. With the continuous development of society, people's demand for building blocks expanded not only in the educational aspect but also for interaction and culture. In the "emotional economic era," parent-child toys have higher emotional experience value than ordinary children's toys, and they serve as an avenue for parent-child communication and emotional engagement (Xu, 2018). It is hoped that children's toys can improve the emotional bond between parents and kids and open up new emotional experiences for both. In terms of culture, children's toys should be rich in cultural meaning, which can be imperceptible in children's preschool education, so that children can adapt to the culture while playing. Creative mortise and tenon structure is a combination of creativity and traditional Chinese mortise and tenon culture. Based on the original mortise and tenon structure, it combines new materials or adds and subtracts to the structure to innovate its expression forms, giving the traditional culture a new language. To preserve the mortise and tenon structure of Chinese traditional excellent culture it should conform to the artistic and aesthetic standards pursued by modern people, (Xie, 2023). Building blocks are nourished by traditional Chinese culture, which is also an embodiment of cultural confidence. As a result, playing is no longer boring and at the same time conveys traditional Chinese

culture. Establishing cultural confidence in children from an early age helps them enhance self-esteem, a sense of identity, and pride in their country's culture. It is not only a very important part of the process of children's growth, but it also gives children's toys a deeper meaning.

Table 1: Summary of Literature Features

Research Direction	Reference	Trait
Child safety	"Thoughts on Safety Standards for Children's Toys" "Children's Toys Call for Safety" "Are Children's Toys Safe"	Due to the risk of the material structure of children's toys, the safety of children's toys has been controversial. Safe children's toys have always been the goal pursued by the market, and the safety of children is crucial.
Building block toy	"Research on the emotional design of children's building blocks" "Design and Research on Children's building blocks" "Research and Design of parent-child toys based on emotional experience" "Research and design of building blocks" "Talk about the appearance and structure design of modern building blocks" "Classic building blocks Educational toys" "Building blocks are the most valuable toys for parenting" "Mathematical intelligence building blocks design and use" "Let toys Make the best use of things -- Introduce several ways of building blocks"	When building blocks were developed in the early years, both at home and abroad, more attention was given to wisdom, which often combined building blocks with intellectual learning. Early building blocks were more for the purpose of education. At present, building block toys have become more interactive and cultural, and parents are more willing to use toys to promote the development of parent-child relationships at the same time, more cultural toy products can affect children in a subtle way.
Building block toys with mortise and tenon structure	"The design and application of creative mortise and tenon and Tenon building blocks for Children", "Research on the Design of children's building blocks based on Traditional Ancient Buildings", "Design of building blocks with the theme of Chinese Traditional Culture", "The toy market has quietly changed -- Where Traditional building blocks are Going," "The Inspiration of Mortise and tenon Structure Series Creation Thoughts"	It is an important part of Chinese traditional culture, which can increase the cultural character of toy products and integrate them into children's toys so that children can be influenced by traditional culture. While establishing cultural confidence from a young age, the flexible mortise and tenon structure can promote children's thinking and parent-child interaction when children cannot complete it independently, and it can also promote parent-child communication on the other hand.

### 3. Mortise and Tenon Structure Concept and its Application

#### 3.1. Theoretical Basis of Mortise and Tenon Structure Concept

Mortise and tenon structure, as the core technology of traditional Chinese wood building, carries rich cultural thoughts and design concepts. Its profound theoretical foundation is reflected in the exquisite technique and integrated into Chinese philosophy, nature, and aesthetics.

The mortise and tenon structure has a long historical foundation and profound cultural connotation. Through the simple combination of mortise and tenon and tenon, the tenon and tenon structure implies the stable connection between the wood. This

connection method retains the characteristics of the wood while connecting them. The combination of concave and concave mortise and tenon structure also reflects the complementary relationship between Yin and Yang. The theory of Yin and Yang and the five elements is an important part of ancient Chinese philosophy, which holds that everything in the universe is composed of the two poles of Yin and Yang and the five elements (wood, fire, earth, metal, and water). In the mortise and tenon structure, Yin and Yang are opposite and interdependent, and the relationship between the five elements is also reflected in it. The application of this philosophical thought makes the mortise and tenon structure reach a very high level in terms of strength and stability, reflecting certain mechanical principles and the mortise and tenon structure has excellent performance in the mechanical principles. It makes use of the bite relationship between mortise and mortise so that the stress can be dispersed when the wood is stressed and the overall stability of the structure can be improved. At the same time, the mortise and tenon structure also makes full use of the elasticity and toughness of wood, so that the building can have a certain deformation space when it is subjected to external force and enhances the seismic performance of the building. Most of the mortise and tenon structures are made of wood, which is sustainable and durable. Due to the tight connection between the mortise and the mortise, the building is not easy to lose or damage during long-term use. Coupled with the simple aesthetics of the mortise and tenon structure, it is reflected in its simple but complex design. It does not have too much decoration and complicated structure, but it can show a unique charm through clever combinations and fine craft. This simple and uncompromising aesthetic style makes the mortise and tenon structure play an irreplaceable role in traditional Chinese architecture. At the same time, wood, as a natural material, has good durability and stability, which makes the mortise and tenon structure withstand the test of time. Since then, there have been modern advanced sustainable development concepts. It reflects the cultural nature of the mortise and tenon structure and ideological foundation.

Its long history can be traced back to the new period of civilization when people found a large number of wooden components of mortise and tenon structures in the Hemudu site. At that time the structure was mainly used in the construction of columnar houses in Hemudu. Because of its stable structure, it is widely used in house construction, and later it is also widely used in furniture and toys. There are hundreds of types of mortise and tenon structures, the common are lattice corner tenon, corner tenon, dumpling corner tenon, dovetail tenon, clamp tenon, shoulder tenon, dragon and phoenix tenon, fence tenon, half tenon, horse pin and so on. The classification of mortise and tenon structures is based on the connection of points, lines, and planes (Xie, 2023). Its application is flexible and varied, and its application in furniture not only makes the furniture firmly connected, but also stable, and has a certain seismic performance, and the mortise and tenon structure used in Ming furniture is a typical example. Ming furniture after a hundred years of historical change can remain intact until today because of its use of mortise and tenon structure. The application of mortise and tenon structure in Ming furniture reflects the beauty of its material, structure, artisan, and craftsmanship. Over time structural beauty established the "line" as the main form language of modeling techniques, reflecting the bright and fresh artistic style. Only solid and firm mortise and tenon structures with reasonable connections were used in the process. Ming-style furniture makes full use of the natural color and texture of the material. The color is calm and elegant, the wood grain material is natural and beautiful, and the texture is firm and distinct. Ming style furniture is also beautiful in shape, although the style is varied, it is "concise" as it unites all of its elements, such as the lines that are moderately proportionate, thick and clean, steady and generous. The harmonious proportions and beautiful decoration reflect the perfect scale and scientific ergonomics of Ming-style furniture. In addition, the exquisite metal ornament style, and soft color plays an excellent decorative role. It attached the importance of matching the hall building and the ingenious role of decorating the environment and filling the space.

It also embodies certain design principles, such as the unity of heaven and man and "the road is not far." Furniture design is not yet carved to follow the natural balance and suitability, and "you are still in harmony" and "both in quality." The way the table and chair are constructed indicates that it needs to be appropriate and dignified. Considering "middle" as the central idea, its implications, the quest for moderation, its form, criteria, and work for the harmony of shape and wood. There are also "Tao law natural" and "implicit heaven." Reflected in the Ming Dynasty table and chair design show the texture of the wood for the purpose of simplicity and elegance, moist and delicate. Because of the application of mortise and tenon structure, Ming-style furniture became an artistic achievement in the Ming Dynasty. Its design features pay attention to the beauty of structure, material, shape, and decoration, which makes Ming-style furniture meaningful and elegant, beautiful and comfortable, simple and generous, realizing the perfect unity of form and function, and is known as the peak masterpiece in the history of Chinese furniture design.

### **3.2. The Application of Mortise and Tenon Structure in Toy Design**

The flexible properties of mortise and tenon structures have numerous applications in toy design, such as building block toys. Because of these applications, building block toys can be combined in various ways to stimulate children's imagination and creativity and meet the needs of children of different ages. Moreover, It can be used in wooden jigsaw puzzles, where the use of mortise and tenon structure allows for accurate docking of the puzzle pieces, enhancing both the fun and educational value of the toy. A Jigsaw toy uses a mortise and tenon structure, combining several small parts to complete the whole toy. Wooden jigsaw puzzle toys are a typical example, children need to put together many small pieces of wood according to the instructions of the mortise and tenon structure and finally form a complete model. Such toys improve children's hand-eye coordination and observation skills while also helping them to understand the structure of space and the composition of objects. In addition, it can also be used in the making of traditional architectural models. In ancient buildings, mortise and tenon structures were often used to achieve stability and improve the durability of buildings. Architectural models can better restore the real structure of buildings so that children can better experience the wisdom of traditional culture by participating in the patchwork of architectural structures. It can also improve their perception of space structure and aesthetics. The advantages of mortise and tenon structure in toys are mainly reflected in its stability, which ensures the safety of children and also improves the service life of toys. At the same time, mortise and tenon connections are flexible and diverse, and various shapes and structures can be created through different combinations. However, the application of mortise and tenon structures in toy design also faces some challenges. First, the process is demanding, which is a technical challenge for toy manufacturers and requires extra time and cost. Secondly, mortise and tenon structures need to be designed with children's ages in mind to adapt to their needs. For smaller children, simple mortise and tenon structures should be chosen to avoid the risk of swallowing small parts. Finally, the design of the mortise and tenon structure should pay attention to the balance of aesthetics and safety to improve the appeal of the toy. For example, the slogan of "coincidence building blocks is to make Chinese people's building blocks." Coincidental Building Blocks is China's domestic building blocks brand, to create creative mortise and tenon building blocks, and the company recently released a new Sanxingdui mortise and tenon building blocks, launched the "wind and rain" pile four mortise and tenon building toys, pile wind, pile Yu, pile shun, meaning "wind and rain." Children can understand the cultural calendar and non-heritage mortise and tenon process through building blocks toys, and learn while playing. It not only contains the wisdom of mortise and tenon structure but also integrates the ancient Sanxingdui civilization with mortise and tenon building blocks so



that the tenon and tenon building blocks have deeper artistic connotations and cultural significance.



Figure 3: Sanxingdui mortise and tenon building blocks

#### 4. The Design Principle of Rice Husk Building Block Toys

##### 4.1. Analysis of Material Characteristics of Rice Husk Building Blocks

As an environmentally friendly building material with rice husk as the main raw material, rice husk building blocks have unique physical and chemical characteristics. Rice husk is a by-product of rice processing, mainly from paddy fields. As one of the major food crops in the world, rice is widely cultivated, so the yield of rice husks is also considerable. According to statistics, the annual global rice husk production can reach hundreds of millions of tons, which provides sufficient raw materials for the production of rice husk building blocks.

Through a reasonable design and manufacturing process, rice husk blocks can demonstrate good stability and load-bearing capacity, while maintaining a high environmental value and sustainability. As a natural organic material, rice husk blocks have good biodegradability. In the natural environment, rice husks can be broken down into carbon dioxide and water by microorganisms without causing pollution to the environment. This feature makes the rice husk building blocks perform well in terms of environmental protection during use. The use of rice husk as the raw material of building blocks not only reduces the production cost but also reduces the dependence on limited wood resources, which is conducive to the protection of forest resources. In addition, there is no need to use chemical adhesives in the manufacturing process, reducing the impact on the environment. Therefore, rice husk blocks have high environmental protection value. Due to its biodegradable properties, it is not dangerous when accidentally ingested, because it can be digested by the human body. The application in children's toys will be perfect for safeguarding kid's safety.

Table2:Material Analysis

Texture	Wood	Rice husk
Shore hardness	89.5	89
Density (kg/m <sup>3</sup> )	550	125
Edibility	No	Yes

##### 4.2. The Application of Mortise and Tenon Structure in the Design of Rice Husk Building Block Toys

Mortise and tenon structure, as a unique connection method in ancient Chinese architecture, its principle is to combine the wooden parts through the concave-convex connection. This kind of structure has not only been widely used in traditional Chinese wood buildings but has also given new life to modern design, especially under the concept of environmental protection and sustainable development, such as the application of rice husk blocks.

The application of mortise and tenon structures in rice husk building blocks is reflected in the splicing and combination of building blocks. Through, reasonable design, the connection between rice husk building blocks can be tighter and more stable, to



make it easier for the users to splice and combine various shapes and structures. Rice husk blocks are more versatile, which boosts their use and enjoyment while also increasing their usefulness in games and teaching. The age characteristics and safety of children are taken into consideration to avoid the risk of children swallowing small pieces. For smaller children, the design of the toy will be simpler and the mortise and tenon structure will be relatively large. At the same time, the rice husk material has good toughness and is fall-resistant, which can protect children's safety when playing to a certain extent. The mortise and tenon structure of rice husk building block toys also pays attention to the combination of aesthetics and creativity. Designers can make different shapes and colorful rice husk building blocks according to different themes and creativity. The blocks can serve as educational tools to help children understand basic concepts such as shape, color, and spatial structure.

In addition, the application of mortise and tenon structures in rice husk building blocks also helps improve the durability and longevity of the building blocks. Because the mortise and tenon structure makes the connection between the building blocks tighter, it can effectively prevent the building blocks from becoming loose or damaged during use. This not only extend the service lifespan of the rice husk building blocks but also reduce maintenance costs for users.

To sum up, the application of mortise and tenon structures in rice husk building blocks not only reflects the wisdom of traditional Chinese architectural culture but also gives higher performance and value to rice husk building blocks. This combination of traditional and modern design concepts not only helps to promote the application of the concept of environmental protection and sustainable development in the construction industry but also provides new ideas and directions for future architectural design.



Figure 4: Rice husk building block toy

### 4.3. Innovative Design Concept of Rice Husk Building Block Toys

The innovation of rice husk building block toys uses discarded rice husks as the main material, this approach effectively reuses and recycles waste, while promoting environmental protection and sustainable development. Children can also digest rice husk toys according to their unique digestive systems when eaten. Rice husk building block toys can stimulate children's creativity and imagination and also teach them the concept of environmental awareness and sustainable development through the game. At the same time, stacked games can also help children exercise hand-eye coordination and spatial perception. Another innovation of the rice husk building block toy is its biodegradability. When the toy is no longer in use, the building blocks can be safely put back into the soil for composting, further reflecting its environmental protection and sustainable characteristics. The concept of environmental protection and sustainable development is integrated into the toy, which ensures the safety of children and embodies its good educational value and social impact. It is an innovative toy with both interesting and educational value.

## 5. Sustainable Development of Rice Husk Building Block Toy Design

### 5.1 Sustainable Design of Rice Husk Building Block Toys

**Rice material sustainability** - Rice husks are a renewable resource, and using them as the primary material for rice husk toys helps reduce waste and environmental pollution. The design meets the requirements of sustainable development and shows care and protection of natural resources. First of all, in terms of material selection, around 120 million tons of rice husks are discarded worldwide every year as a kind of agricultural waste. This waste rice husk is the main material used to make children's block toys in Daohusk Village. This practice not only effectively uses agricultural waste but also reduces waste generation and reduces the pressure on the environment.

**Sustainability of the production process** - A fully sustainable production process is used in the creation of rice husk toys. There is no need to use too many chemical adhesives or other harmful substances in the production process because the rice husk has a strong structure and robustness. This simple and environmentally friendly production method not only reduces the product's burden on the environment but also improves its level of safety. In addition to making the toy safe for the human body, this design method minimizes the environmental damage caused by chemical adhesives on the environment.

**Use process sustainability** - Through the modular design of the rice husk toy, children's habits and interests are fully considered so that children can create their unique toy village. This design method stimulates children's creativity and imagination aside from more fun and interaction. At the same time, rice husk toys meet the requirements of sustainable development and do not require too much energy or produce too much waste during use.

**Product life cycle sustainability** - At the end of their life cycle, rice husk toys can be biodegraded and composted, which prevents waste from polluting the environment and returns the rice husk to its natural state, forming a virtuous cycle. This way of design reflects the sustainability of the product and conforms to the concept of ecological friendliness. Transforming agricultural waste into meaningful products improves the efficiency of resource utilization and also guides people's attention and thinking about sustainable development. This design approach satisfies both consumers' needs and society's expectations for environmental protection.

In summary, the sustainability of rice husk toy design is mainly due to the aspects of the material, production process, usage process, and product life cycle. This design approach meets the requirements of sustainable development, a brand-new and environmentally friendly toy choice. Moreover, it helps reduce environmental pollution and waste of resources, provides a new perspective, and directs attention to sustainable development and environmental conservation.

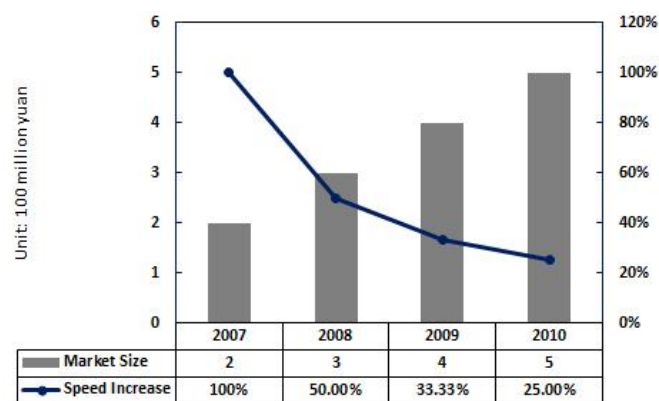


Figure 5: Number of rice husk materials used worldwide  
Source: New Economic Perspectives Network

## 5.2. Cultivation of Environmental Awareness of Rice Husks Building Block Toys

One kind of agricultural waste that is annually treated is rice husk, which is often burned or dumped in a landfill. However, making toys out of rice husks is a great way to reuse waste and protect the environment. Since rice husk material is an agricultural product, it naturally degrades over time, so there is no need to worry about pollution after reuse. Additionally, used rice husk building block toys can be reprocessed into different shapes, such as traditional ancient buildings, building block puzzles, etc., and reused because the material will deform after compression. Therefore, it can be recycled into compost or processed further to achieve the environmentally friendly reuse of toy materials. Additionally, it can decompose naturally when it is not needed anymore showing awareness of sustainable development of material development and environmental preservation. Rice husk building blocks are highly sustainable. First of all, rice husk is a renewable resource with a high output that can meet long-term production demands. Second, rice husk building blocks are manufactured without the use of chemical binders, reducing the impact on the environment. In addition, rice husk blocks are naturally biodegradable and may be broken down after usage reducing the pressure on garbage disposals. Therefore, rice husk blocks contribute to the advancement of resource recycling and sustainable development of the environment.

### **5.3. Application Prospect of Rice Husk Building Block Toys in the Field of Education**

Building block toys are a kind of educational toy, with certain educational value. To help children better understand and integrate into their learning career, early building block toys are generally combined with mathematics and other academic subjects to provide learning instruction. Rice hull building blocks have a wide range of application prospects in the field of education. First of all, because they are made of environmentally friendly materials, rice husk building block toys can help children develop awareness of and responsibility for the environment by guiding them toward environmental protection and sustainable development. This is of great significance for raising citizens who will protect the environment in the future. Secondly, children's hand-eye coordination and spatial imagination are enhanced by the mortise and tenon structure design of rice husk building block toys. In the process of splicing the building blocks, children need to carefully observe the mortise and tenon structure and think about how to correctly connect different building block components. In addition, rice husk building block toys can also be combined with various educational courses, such as mathematics, physics, engineering, and so on. Children may learn relevant knowledge more easily when it is presented to them during playtime, they can master and understand this knowledge, which increases learning interest and effectiveness. Now the combination of building blocks and rice husk material, based on intellectual education enhances children's environmental awareness education, while providing stronger proof that Jinshan Yinshan's green sustainable development concept is characterized by green water and green mountains and has good social benefits. The concept of green environmental protection, the harmonious coexistence of people's better life and the natural environment is the top priority and pursuit of the new era. Rice husk building block toys simply comply with the development trend giving them the dual value of education and environmental protection. As a result, there will be a wide range of application opportunities with the concept and pace of sustainable development in the new era. They can not only guide children to pay attention to environmental protection and sustainable development but also cultivate their creativity and imagination, as well as the ability to combine them into a variety of educational courses. Therefore, it is reasonable to expect an increase in educational institutions and educators incorporating rice husk building block toys into their educational practice in the future, providing children with a more interesting and beneficial learning experience.



Figure 6: Number of rice husk toys  
Source: QY Research

## 6. Conclusion and Prospect

### 6.1. Conclusion

Rice husk building block toy is a new product with creative mortise and tenon structure from the perspective of children's safety. One of the innovative points is safety: rice husk is an edible crop that is naturally grown and organic. Since children like to put toys in their mouths, this is a good solution to the problem of kids eating toys. Environmental protection: Every year, many rice husks are wasted because there is no place to use them. Utilizing rice husks to make toys is just one method of recycling materials that adheres to the concept of organic development and green environmental protection, and is in line with the theme of today's world design. Interactivity: The rice husk adopts the traditional Chinese mortise and tenon structure, which enhances children's hands-on ability and promotes the parent-child relationship as they work together to complete the project. To sum up, the rice husk building block toy which utilizes the mortise and tenon structure, offers not just entertainment but also valuable educational and sustainable benefits. These factors make it an even more compelling choice for building block toys.

### 6.2. Future development direction

Building block toys are essential toys for almost every child in the preschool stage. The materials and structure of these toys have been innovatively made to be safer, and children's adaptability is evident in this regard. Although building block toys have always been expensive, the addition of rice husk material reduces the cost of the toys and increases the likelihood that personalized customization has a greater possibility of realization. Personalized rice husk building block toys could be one of the development trends of the future. The expression of mortise and tenon structure in the form of cartoon characters, cars, buildings, and other forms may lead to more diverse building block toys in the future. It will be no longer limited to a single hexagonal hole open lock, Luban lock, and other forms of expression, that reflect modern life and integration of ancient and modern culture.

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